FINAL ENVIRONMENTAL ASSESSMENT

AUWAHI WIND FARM PROJECT
HABITAT CONSERVATION PLAN

Prepared by

U.S. Fish and Wildlife Service

January 24, 2012

EXECUTIVE SUMMARY

In accordance with Section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, Auwahi Wind has prepared a Habitat Conservation Plan (HCP) to accompany its request to the U.S. Fish and Wildlife Service (USFWS) for an Incidental Take Permit (ITP) for construction and operation of the Auwahi Wind Farm project (Auwahi Wind project) on Maui. Auwahi Wind has also sought an Incidental Take License (ITL) from the Hawaii Department of Natural Resources in accordance with Chapter 195D of the Hawaii Revised Statutes. Species covered under the ITP and ITL would include the Hawaiian petrel (*Pterodroma sandwichensis*), Hawaiian goose (*Branta sandvicensis*), Hawaiian hoary bat (*Lasiurus cinereus semotus*), and Blackburn's sphinx moth (*Manduca blackburni*). These four species are all federally listed as endangered.

The decision by the USFWS to issue an ITP to Auwahi Wind and approve the associated HCP is a Federal action subject to compliance with National Environmental Policy Act (NEPA). As part of the NEPA process, this environmental assessment has been prepared to evaluate the impacts of, and potential alternatives to, issuing an ITP and approving the implementation of the proposed HCP (Table ES-1).

Table ES-1. Summary of impacts associated with implementation of the HCP and construction and operation of the Auwahi Wind project.

Resource	Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3 – Reduced Permit Term
Climate	No effect	HCP Implementation: Minor temporary air emissions (vehicles); long-term benefits through reforestation efforts Auwahi Wind Project: Minor temporary air emissions during construction; long-term benefits through reductions in fossil fuel consumption	Same as Alternative 2 but green house gas benefits reduced unless additional renewable power added after project ceases operation
Geology and Topography	No effect	HCP Implementation: Negligible impacts to geology and topography Auwahi Wind Project: Minor adverse impacts to geology and topography due to ground-disturbing activities, minimized through implementation of BMPs and restoration of disturbed areas	Same as Alternative 2
Soil	No effect	HCP Implementation: Minor short-term soil disturbance during implementation of mitigation measures minimized through implementation of standard BMPs Auwahi Wind Project: Minor short-term soil disturbance during construction and minor long-term soil disturbance during operation, minimized through implementation of standard BMPs	Same as Alternative 2
Natural Hazards	No effect	HCP Implementation: Negligible impacts due to implementation of project Fire Management Plan Auwahi Wind Project: Negligible impacts due to fire prevention measures; monitoring and maintenance of project structures and vegetation; and Fire Management Plan	Same as Alternative 2

Table ES-1. Summary of impacts associated with implementation of the HCP and construction and operation of the Auwahi Wind project.

Resource	Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3 – Reduced Permit Term
Hydrology and Water Resources	No effect	HCP Implementation: No direct impacts to surface water features or impacts to water quality; minor, localized temporary adverse impacts associated with project implementation (erosion) minimized through implementation of standard BMPs (stormwater pollution prevention and temporary erosion and sediment control plan SWPP Plan and TESC Plan); HCP mitigation measures would benefit water resources by increasing soil moisture, slowing runoff, increasing infiltration, and preventing soil damage Auwahi Wind Project: No direct impacts to surface water features; minor, localized temporary adverse impacts associated with project implementation (erosion) minimized through implementation of standard BMPs (SWPPP and TESC Plan); no measureable reduction in the quantity or quality of ground water	Same as Alternative 2
Vegetation	No effect	HCP Implementation: Negligible, short-term adverse impacts due to ground disturbance; no impacts to rare or special status species; long-term beneficial impacts due to native forest restoration efforts Auwahi Wind Project: Permanent removal of 39 acres of vegetation, primarily consisting of grazed grasslands/pastures; no direct impacts to federally listed plants; minor, temporary potential for indirect impacts (fire, invasive plants) minimized through fire and invasive plant prevention measures; a majority of rare plants will be avoided but a few individual rare plants may be removed; mitigation for the Covered Species and plantings of iliahi, red ilima, and aiea will benefit these species. Loss of potential native plant habitat and potential habitat for the following endangered plants which occur in the Kanaio NAR adjacent to the generator-tie line: *Alectryon micrococcus* (Mahoe),*Bonamia menziesii*, *Cenchrus agrimoniodes* (Kamanomano), *Colubrina oppositifolia* (Kauila), *Flueggea neowawraea* (Mehamehame), *Melicope adscendens*(Alani), *M. knudsenii*, *M. mucronulata*. Impacts to potential native plant habitat will benefit from habitat restoration.	Same as Alternative 2

Table ES-1. Summary of impacts associated with implementation of the HCP and construction and operation of the Auwahi Wind project.

Resource	Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3 – Reduced Permit Term
Wildlife	Habitats would remain degraded; no adverse impacts associated with the wind farm but also no beneficial impacts of HCP mitigation measures	HCP implementation: Long-term beneficial impacts due to the protection (fencing) and/or enhancement (outplantings) of native ecosystems; minor net benefit to the Covered Species Auwahi Wind Project: Minor, localized habitat removal; collision potential; and temporary disturbance; impacts would be avoided or minimized through implementation of the HCP. Yellow-faced bees (listing warranted but precluded) or ground nests could be crushed; bees could collide with construction equipment; minor removal of vegetation used for nesting and/or individual plants used for pollen and nectar collection. Impacts avoided because activities outside of preferred bee habitat and minimized through implementation of standard BMPs for invasive plants species, revegetating disturbed areas, and implementing the Fire Management Plan; species would benefit from mitigation for Blackburn's sphinx moths and Hawaiian hoary bats on Ulupalakua Ranch (see below). Requested take of Covered Species: Hawaiian Petrel - Tier 1: 19 adults, 7 chicks; Tier 2: 32 adults, 12 chicks; Tier 3: 64 adults, 23 chicks; mitigation consists of petrel management measures (conducting predator control and monitoring) at the Kahikinui Forest Project to offset take by increasing survival and reproduction. Hawaiian hoary bat - Tier 1: 5 adults, 2 young; Tier 2: 10 adults, 4 young; Tier 3: 19 adults, 8 young; mitigation consists of habitat restoration measures at Waihou Mitigation Area (fencing, ungulate removal, and outplanting) and radio-telemetry research project Hawaiian goose - 5 adults; mitigation consists of funding to conduct predator control or support egg and gosling rescue at Haleakala National Park Blackburn's sphinx moth - 0.3 acres of native habitat and 27.7 acres of degraded habitat.lost; mitigation consists of funding to the LHWRP to restore dryland forest in the Auwahi Forest Restoration Project with outplantings of larval and adult host plants.	HCP Implementation: Same avoidance, minimization, and mitigation measures as Alternative 2, but fewer acres protected or enhanced for petrels and bats because mitigation reduced due to lower take Auwahi Wind Project: Similar impacts as under Alternative 2 but shorter duration; reduced take of Covered Species due to 21-year operating period versus 25 years

Table ES-1. Summary of impacts associated with implementation of the HCP and construction and operation of the Auwahi Wind project.

Resource	Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3 – Reduced Permit Term
Land Use	No effect	HCP Implementation: No land use impacts Auwahi Wind Project: Negligible, short-term adverse impacts to land use due to disruption of grazing during construction; no impacts would occur during operation; in compliance with existing land uses, plans, and policies	Same as Alternative 2
Transportation and Traffic	No effect	HCP Implementation: Negligible impact due to minor traffic association with implementing mitigation measures Auwahi Wind Project: Minor, short-term adverse impacts due to construction traffic and transportation of superloads, mitigated through implementation of traffic management plan; long-term beneficial impact due to road improvements	Same as Alternative 2, except shorter duration of minor traffic impacts due to shorter operating period
Visual Resources	No effect	HCP Implementation: Minor impacts due to Waihou (and Kahikinui should that become a viable optionin the future) mitigation fence; long-term increase in scenic value of mitigation sites due to reforestation Auwahi Wind Project: Minor, short-term adverse impacts during construction due to dust; moderate long-term visual impacts due to visibility from highway mitigated through design and lighting measures	Same as Alternative 2
Air Quality	No effect	HCP Implementation: Minor, short-term adverse impacts due to vehicle emissions and dust Auwahi Wind Project: Minor, short-term adverse impacts due to vehicle emissions and dust; long-term beneficial impacts due to reduction in fossil fuel consumption	Same as Alternative 2 but long-term beneficial impacts resulting from fossil fuel consumption reduced
Noise	No effect	HCP Implementation: Minor, short-term noise impacts due construction equipment and vehicles Auwahi Wind Project: Minor, short-term noise impacts during construction; project would comply with the Hawaii Department of Health (HDOH) permit requirements and construction traffic would be split between two access routes to minimize impacts; minor, long-term noise impacts during operation, but all noise within EPA guidelines	HCP Implementation: Minor, short-term noise impacts due to construction equipment and vehicles; impacts reduced from Alternative 2 due to shorter work periods for installation of mitigation fence Auwahi Wind Project: Same as Alternative 2 during construction but shorter duration during operation due to shorter operating period

Table ES-1. Summary of impacts associated with implementation of the HCP and construction and operation of the Auwahi Wind project.

Resource	Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3 – Reduced Permit Term
Cultural Resources	No effect	HCP Implementation: All cultural resources would be avoided Auwahi Wind Project: All culturally significant sites (those meeting criteria "c" and "e" under the National Historic Preservation Act (NHPA)) would be avoided; potential for moderate adverse impacts to some cultural resources meeting criterion "d" (information potential) possible, but fully mitigated through treatments, approved by the State Historic Preservation Division (SHPD), directed toward cultural resources data collection	Same as Alternative 2
Socioeconomic Resources	Minor adverse impact to local economy	HCP Implementation: Minor beneficial impacts due to temporary job creation Auwahi Wind Project: Minor, short-term and long-term benefits due to job creation; long-term benefits due to potential stabilization of electricity rates	Same impacts as Alternative 2 but long-term potential benefit due to stabilization of electricity rates reduced
Hazardous and Regulated Materials and Wastes	No effect	HCP Implementation: Negligible impacts due to implementation of standard BMPs Auwahi Wind Project: Negligible impacts due to implementation of standard BMPs	Same as Alternative 2
Public and Construction Safety	No effect	HCP Implementation: Negligible impacts due to adherence to industry design standards and implementation of the Site Safety Handbook Auwahi Wind Project: Negligible impacts due to adherence to industry design standards and implementation of the Site Safety Handbook	Same as Alternative 2
Public Infrastructure and Services	No effect	HCP Implementation: Negligible impacts due to small number of workers Auwahi Wind Project: Minor increases in the requirement for electricity, water, waste facilities, and wastewater treatment, and police and fire services; long-term beneficial impacts by providing a reliable source of power to Maui Electric Company (MECO) grid	Same as Alternative 2 but long term benefit of providing reliable source of power to MECO grid potentially reduced

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ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
μg/m3	micrograms per cubic meter
AIS	Archaeological Inventory Survey
ALISH	Agricultural Lands of Importance to the State of Hawaii
APE	Area of Potential Effect
Applicant	Auwahi Wind Energy LLC
ASL	above sea level
ASTM	American Society for Testing Materials
ATC Makena	ATC Makena Holdings LLC
ATST	Advanced Technology Solar Telescope
Auwahi DEIS	Draft Environmental Impact Statement for the Auwahi Wind Farm
Auwahi Wind	Auwahi Wind Energy LLC
BESS	battery energy storage system
BLNR	Board of Land and Natural Resources
BMP	Best Management Practice
BTP	Burial Treatment Plan
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CIAA	cumulative impacts analysis area
CO	carbon monoxide
CO_2	carbon dioxide
CO_2E	carbon dioxide equivalent
Covered Species	Hawaiian petrel, Hawaiian hoary bat, Blackburn’s sphinx moth, and Hawaiian goose
CUP	County Special Use Permit
CWA	Clean Water Act
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
dBA	A-weighted decibel
DBEDT	Hawaii Department of Business Economic Development and Tourism
DHHL	Department of Hawaiian Home Lands

DLNR	Hawaii Department of Land and Natural Resources
DOE	U.S. Department of Energy
DOFAW	Hawaii Department of Forestry and Wildlife
DPW	(Maui County) Department of Public Works
DWS	Hawaii Department of Water Supply
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMF	electric and magnetic field
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESRC	Endangered Species Recovery Committee
FAA	Federal Aviation Administration
FE	Federal Endangered
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FR	Federal Register
ft	feet
GE	General Electric
GHG	greenhouse gas
GWP	global warming potential
H_2S	hydrogen sulfide
ha	hectare
HAAQS	Hawaii ambient air quality standards
HAR	Hawaii Administrative Rules
HCP	Habitat Conservation Plan
HDOH	Hawaii Department of Health
HDOT	Hawaiian Department of Transportation
HECO	Hawaiian Electric Company
HMWM	Hazardous Materials and Waste Management
HRHP	Hawaii Register of Historic Places
HRS	Hawaii Revised Statutes
HSOC	Hawaiian Species of Concern
HVNP	Hawaii Volcanoes National Park

IBC	International Building Code
IEC	International Electrotechnical Commission
IPCC	Intergovernmental Panel on Climate Change
ISD	IO silt loam
ISO	International Organization for Standardization
ITL	Incidental Take License
ITP	Incidental Take Permit
KDIE	Kaipoipoi loam
KGKC	Kamaole very stony silt loam
km	kilometer
KOP	key observation point
kph	kilometers per hour
kV	kilovolt
KXD	kula loam
LHWRP	Leeward Haleakala Watershed Restoration Partnership
m	meter
MBTA	Migratory Bird Treaty Act
MECO	Maui Electric Company
MGD	million gallons per day
MISC	Maui Invasive Species Committee
MLBC	Maui Lanai Burial Council
mph	miles per hour
MW	megawatt
MWh/year	megawatts per year
MXC	Madena loamy stony complex
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAR	Natural Area Reserve
NCSS	National Cooperative Soil Survey
NEPA	National Environmental Policy Act
NESC	National Electric Safety Code
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service

NO_X	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSF	National Science Foundation
NSR	noise sensitive receptor
O&M	operations and maintenance
O_3	ozone
OED	Oanapuka series
OPGW	optical ground wire
OSHA	Occupational Safety and Health Administration
PCMP	Post-Construction Monitoring Plan
PM_{10}	particles of 10 micrometers or less in diameter
$PM_{2.5}$	particles of 2.5 micrometers or less in diameter
project	Auwahi Wind project
rCl	cinder land
rLW	lava flows
ROD	Record of Decision
rpm	revolutions per minute
RPS	renewable portfolio standard
rVs	very stony land
SAIS	Supplemental AIS
SCADA	supervisory control and data acquisition
SE	State Endangered
Service	U.S. Fish and Wildlife Service
SHPD	State Historic Preservation Division
SMA	Special Management Area
SOC	Species of Concern
SO_X	sulfur oxides
SPCC	Spill Prevention, Containment, and Countermeasures
SWPP	Stormwater Pollution Prevention
TESC	Temporary Erosion and Sediment Control

Tetra Tech	Tetra Tech EC, Inc.
U.S.C.	U.S. Code
UBC	Uniform Building Code
ULD	Ulupalakua silt loam
UME	Uma loamy coarse sand
UMF	Uma loamy coarse sand
URD	Uma rocky loamy coarse sand
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USGS-BRD	U.S. Geological Survey Biological Resources Division
V	volt
WTG	wind turbine generator
WWTP	wastewater treatment plant

1.0 INTRODUCTION

The U. S. Fish and Wildlife Service (USFWS) has prepared this environmental assessment (EA) of the anticipated effects on the human environment of issuing an Incidental Take Permit (ITP), pursuant to section 10(a)(1)(B) of the Endangered Species Act (ESA), to Auwahi Wind Energy LLC (Auwahi Wind, or Applicant), a subsidiary of Sempra Generation. The ITP would authorize the incidental take of the endangered Hawaiian petrel (*Pterodroma sandwichensis*), endangered Hawaiian goose (*Branta sandvicensis*), endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), and the endangered Blackburn's sphinx moth (*Manduca blackburni*), collectively referred to as Covered Species. The ITP would cover activities carried out in conjunction with the implementation of the Auwahi Wind project Habitat Conservation Plan (HCP) on the Island of Maui, Maui County, Hawaii. The EA was prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) (42 United States Code [U.S.C.] §4321 et seq.) and Council on Environmental Quality (CEQ) regulations, as amended (40 Code of Federal Regulations [CFR] §1500 et seq.).

The ESA prohibits "take" of federally listed species, defining take as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect such species or to attempt to engage in any such conduct." Section 10(a)(1)(B) of the ESA defines incidental take as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Section 10(a)(1)(B) allows the USFWS to issue an ITP to a non-Federal entity for incidental take of federally listed species, provided certain criteria are met. Under section 10(a)(2)(A), any application for an ITP must include a "conservation plan" detailing, among other things, the impacts of the incidental take allowed by the ITP on affected Covered Species and how the impacts will be minimized and mitigated. Incidental Take Permit issuance criteria are prescribed in Title 50 Code of Federal Regulations (CFR) 17.22(b), 50 CFR 17.32(b)(2), and section 10(a)(1)(B) of the ESA.

Auwahi Wind is requesting an ITP for incidental take of the Covered Species that may occur as a result of the proposed construction and operation of the Auwahi Wind project. Auwahi Wind has prepared a draft HCP, to accompany its application for an ITP. The USFWS recognizes that the construction and operation of the project could affect federally listed threatened or endangered species including the Covered Species. Individuals of these species have the potential to be killed or injured if they collide with the project's wind turbine generators (WTGs) or other project facilities. Incidental take of the Blackburn's sphinx moth could also occur through habitat removal during construction. The decision by the USFWS to issue an ITP to Auwahi Wind and approve the associated HCP is a Federal action subject to compliance with NEPA. The proposed term of the ITP and HCP is 25 years.

Auwahi Wind is also seeking an Incidental Take License (ITL) in accordance with Chapter 195D of the Hawaii Revised Statutes (HRS) to authorize potential impacts to these same four species. The ITL is issued by the Hawaii Department of Land and Natural Resources (DLNR). The draft HCP was approved and published in the Office of Environmental Quality Control bulletin on July 7, 2011. A State Final Environmental Impact Statement (EIS) for the construction and operation of the Auwahi Wind project was published in the state Office of Environmental Quality Control bulletin on August 23, 2011 (Tetra Tech 2011).

The Auwahi Wind project, located on the island of Maui, would consist of 8 WTGs and have a net generating capacity of 21 megawatts (MW), augmented with a battery energy storage system (BESS). In addition to the WTGs and the BESS, the proposed project would include an electrical collection system, an operations and maintenance (O&M) facility and related infrastructure, an approximately

9-mile (14.5-kilometer) 34.5-kilovolt (kV) generator-tie line[1], an interconnection substation, and a 27-mile (44-kilometer) construction access route from the Port of Kahului to the wind farm site. The Auwahi Wind project is located primarily on Ulupalakua Ranch. Figures 1-1 and 1-2 depict the location and layout of the project.

1.1 PURPOSE AND NEED FOR THE FEDERAL ACTION

1.1.1 Purpose of the Federal Action

The purpose of the Federal action is to evaluate the authorization of incidental take of the Hawaiian hoary bat, Hawaiian petrel, Hawaiian goose, and Blackburn's sphinx moth associated with otherwise lawful construction and operation of the Auwahi Wind project as described in the HCP. Incidental take is defined as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." Auwahi Wind is seeking authorization because activities associated with the construction and operation of the Auwahi Wind project may result in the take of Covered Species. Because the decision to issue an ITP is a Federal action, it is subject to compliance with NEPA.

The USFWS's purpose for this action is to:

- Respond to the application by Auwahi Wind for an ITP from USFWS for the proposed Covered Species related to activities that have the potential to result in take, pursuant to the requirements of ESA section 10(a)(1)(B) and its implementing regulations and policies;
- Protect, conserve, and enhance the Covered Species and their habitat for the continuing benefit of the people of the United States;
- Provide a means and take steps to conserve ecosystems depended on by the Covered Species; and
- Ensure the long-term survival of the Covered Species through protection and management of the species and their habitat.

1.1.2 Need for the Federal Action

The USFWS is the lead Federal agency for implementing the regulatory requirements of the ESA as it relates to the proposed Auwahi Wind project. The USFWS' action is the decision to issue the ITP and approve the HCP, or deny the permit if the HCP does not meet the criteria of section 10(a)(1)(B) of the ESA. The issuance of the requested ITP constitutes a Federal action that may affect the human environment, and therefore the USFWS is required by NEPA to evaluate the impacts that the Proposed Action and identified alternatives would have on the human environment.

[1] A "generator-tie line" is a sole-use facility constructed by a private electric generator to interconnect and transmit its power to the electric grid. Although this project component has been referred to as a "transmission line" in previous documents, the correct term is generator-tie line. A "transmission line" is an electrical line constructed by a traditional public utility, which must provide open access to that line to any party that requests it. The approximately 14.5-kilometer (9-mile) electrical line proposed by Auwahi Wind is more accurately termed a generator-tie line, in that it is a sole-use facility being proposed by a private developer to interconnect the wind project to the Maui Electric Company electric grid.

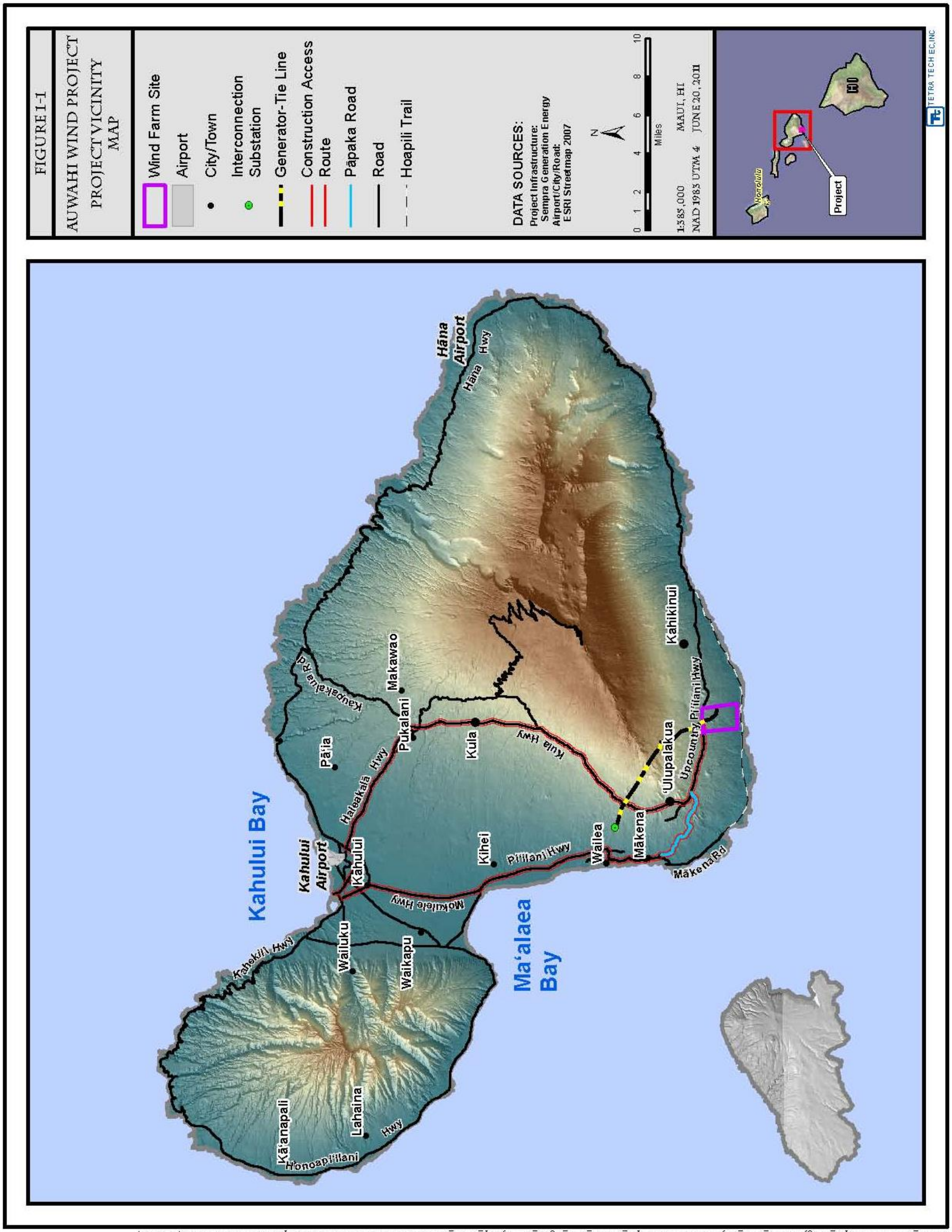


FIGURE 1-1
AUWAHI WIND PROJECT
PROJECT VICINITY MAP
Wind Farm Site
Airport
City/Town
Interconnection Substation
Generator-Tie Line
Construction Access Route
Pāpaka Road
Road
Hoapili Trail
DATA SOURCES:
Project Infrastructure:
Sempra Generation Energy
Airport/City/Road:
ESRI Streetmap 2007
N
0 1 2 4 6 8 10
Miles
1:385,000
NAD 1983 UTM 4
MAUI, HI
JUNE 20, 2011
Project
TETRA TECH EC, INC
Kahului Bay
Ma'alaea Bay
Kahului Airport
Hāna Airport
Hāna Hwy
Kahului
Wailuku
Waikapu
Lahaina
Kā'anapali
Honoapi'ilani Hwy
Kahekili Hwy
Mokulele Hwy
Kihei
Pi'ilani Hwy
Wailea
Mākena
Mākena Rd
'Ulupalakua
Upcountry Pi'ilani Hwy
Kula
Kula Hwy
Pukalani
Makawao
Pā'ia
Haleakalā Hwy
Kaupakalua Rd
Kahikinui

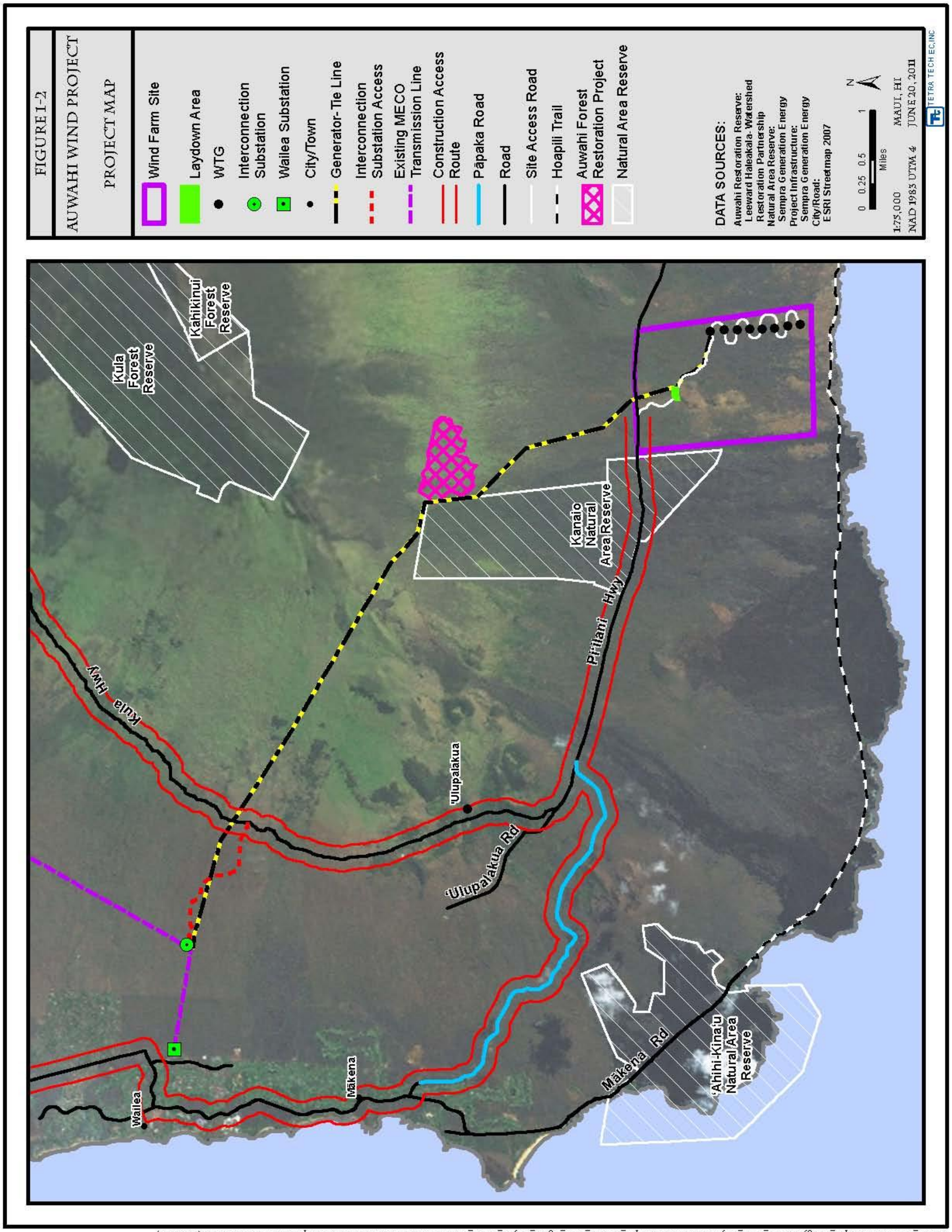


FIGURE 1-2
AUWAHI WIND PROJECT
PROJECT MAP
Wind Farm Site
Laydown Area
WTG
Interconnection Substation
Wailea Substation
City/Town
Generator-Tie Line
Interconnection Substation Access
Existing MECO Transmission Line
Construction Access Route
Papaka Road
Road
Site Access Road
Hoapili Trail
Auwahi Forest Restoration Project
Natural Area Reserve
DATA SOURCES:
Auwahi Restoration Reserve:
Leeward Haleakala- Watershed Restoration Partnership
Natural Area Reserve:
Sempra Generation Energy
Project Infrastructure:
Sempra Generation Energy
City/Road:
ESRI Streetmap 2007
0 0.25 0.5 1
Miles
N
1:75,000
NAD 1983 UTM 4
MAUI, HI
JUNE 20, 2011
TETRA TECH EC, INC
Kula Forest Reserve
Kahikinui Forest Reserve
Kanaio Natural Area Reserve
Kula Hwy
Pi'ilani Hwy
'Ulupalakua
'Ulupalakua Rd
Mākena Rd
'Āhihi-Kīna'u Natural Area Reserve
Wailea
Mākena
F:\GIS_PROJECTS\Sempra_Energy\Auwahi_Wind_Project\MXDs\FEIS\Sempra_Auwahi_FEIS_Fig1-2_Project_85111_062811 - Last Accessed: 6/28/2011 - Map Scale correct at: ANSI A (11" x 8.5")

1.2 APPLICANT'S PURPOSE AND NEED FOR THE AUWAHI WIND PROJECT

Of the 50 states, Hawaii is the most dependent on imported energy. Hawaii is one of the world's most remote island chains and has no fossil fuel resources of its own. In 2005, approximately 95 percent of Hawaii's primary energy was derived from imported fossil fuels such as petroleum and coal (Global Energy Concepts 2006). Consequently, Hawaii's consumer energy prices are some of the highest in the nation and the state is exceedingly vulnerable to fluctuations in resource availability.

In an attempt to alleviate its dependence on imported fuels, Hawaii established a Renewable Portfolio Standard (RPS) that requires Hawaiian Electric Company (HECO) and its affiliates, Hawaii Electric Light Company and Maui Electric Company (MECO), to generate renewable energy equivalent to 10 percent of their net electricity sales by 2010, 15 percent by 2015, 25 percent by 2020, and 40 percent by 2030. The Global Warming Solutions Act of 2007 requires that Hawaii's greenhouse gas (GHG) emissions be reduced to levels at or less than 1990 levels by January 2020. On January 28, 2008, Hawaii also signed a Memorandum of Understanding with the U.S. Department of Energy (DOE) that established the Hawaii Clean Energy Initiative, under which at least 70 percent of Hawaii's energy needs would be supplied by renewable resources by the year 2030.

These regulations and initiatives reflect Hawaii's commitment to move away from petroleum-based energy generation and to increase its portfolio of renewable energy projects. Collectively, they demonstrate the overwhelming need for the development and implementation of renewable energy projects throughout the state.

As of December 31, 2010, 26.1 percent of MECO's sales were from renewable energy sources (MECO 2011). As proposed, the Auwahi Wind project could provide 78,500 megawatt-hours per year (MWh/year) of electricity to MECO's grid, enough to provide electricity to approximately 10,000 households based on the average statistics reported by the American Wind Energy Association (AWEA 2010).

The purpose of the Auwahi Wind project is to provide clean, renewable wind energy for the island of Maui, and assist MECO in meeting Hawaii's RPS requirements. Toward that end, MECO is requiring that the Auwahi Wind project begin operation by December 2012 and has set forth that requirement as a key term in its Power Purchase Agreement with Auwahi Wind. The power generated by the Auwahi Wind project would be sold to MECO under a long-term, fixed-price contract with fixed annual escalation providing long-term price stability for consumers.

Auwahi Wind anticipates that (1) operation of the Auwahi Wind project would contribute to the state's portfolio of renewable energy projects and provide environmental and economic benefits to the state and the local community; (2) the operation of the wind farm would demonstrate that renewable energy uses can coexist with agricultural and ranching uses in rural Maui; and (3) once the Auwahi Wind project has been developed, Ulupalakua Ranch would continue to use the parcel for cattle pasture as it has done for decades.

1.3 REGULATORY FRAMEWORK AND RELATIONSHIP TO OTHER PLANS, POLICIES, AND LAWS

Other Federal, State, and local statutes, regulations, and policies may govern the activities proposed for ITPs under the HCP. While some regulations may require issuance of environmental permits prior to project implementation, others may require agency consultation. A brief summary of other related regulations, laws, and plans or policies is provided below.

This document has been prepared in accordance with the NEPA (42 U.S.C. §4321 et seq.); CEQ regulations, as amended (40 CFR §1500 et seq.) and section 10(a)(1)(B) of the ESA as amended. Auwahi Wind is required to comply with the USFWS ITP requirements, including preparation of an HCP in accordance with the ESA. An ITL must also be obtained from the Hawaii DLNR in accordance with Chapter 195-D of the HRS.

No other Federal permits are required for the project. However, the USFWS must comply with the National Historic Preservation Act (NHPA) as required for issuance of the Federal ITP. In addition, a Notice of Proposed Construction or Alteration was submitted to the Federal Aviation Administration (FAA) for concurrence that the WTGs pose no hazard to air navigation in May 2011 (14 CFR § 77) and the FAA Notice of Determination was received August 2011.

1.3.1 Endangered Species Act

The ESA and its implementing regulations prohibit the take of any fish or wildlife species that is federally listed as threatened or endangered without prior approval pursuant to either Section 7 or Section 10 (a)(1)(B) of the ESA. Section 9 of the ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." The term harm means an act that actually kills or injures a federally listed wildlife species, and may include significant habitat modification or degradation (50 CFR §17.3). In addition, Section 9 of the ESA details generally prohibited acts and Section 11 provides for both civil and criminal penalties for violators regarding species federally listed as threatened or endangered.

ESA section 4(f) requires the USFWS to develop and implement recovery plans for the conservation and survival of listed species. Recovery plans must describe specific management actions, establish objectives and measurable criteria for delisting, and estimate the time and cost to carry out measures needed to achieve recovery. The USFWS has developed recovery plans for the Hawaiian petrel, Hawaiian hoary bat, Hawaiian goose, and Blackburn's sphinx moth (USFWS 1983, 2004, 2005a, b). The biological goals and objectives identified in Section 5.1.1 of the HCP will be consistent with these recovery plans.

In 1982, Congress amended the ESA to allow a private applicant to incidentally take an ESA-listed species that would otherwise be prohibited under Section 9(a)(1)(B). When a non-federal landowner wishes to proceed with an activity that is legal in all other respects, but that may result in the incidental taking of a listed species, an ITP, as defined under Section 10 of the ESA, is required. Incidental take is defined as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity" (50 CFR § 17.3). An HCP must accompany an application for an ITP to demonstrate that all reasonable and prudent efforts have been made to avoid, minimize, and mitigate for the effects of the potential incidental take.

Guidance for preparation and required components of an HCP are provided in the USFWS HCP Handbook (USFWS and NMFS 1996). The USFWS and National Marine Fisheries Service (NMFS) issued an addendum to the handbook in 2000 (USFWS and NMFS 2000). Known as the Five-point Policy, this addendum provides additional guidance on: (i) establishing and stating biological goals for HCPs; (ii) clarifying and expanding the use of adaptive management where there is uncertainty about the experimental design and scientific evidence with respect to the HCP's approach to conservation; (iii) clarifying the purpose and means of how to undertake species and habitat monitoring; (iv) providing criteria to be considered by in determining incidental take permit duration; and (v) expanding public participation.

1.3.1.1 ESA Section 10

Under provisions of the ESA, the Secretary of the Interior (through the USFWS) may issue a permit for the incidental taking of a listed species if they find that the application conforms to the issuance criteria identified section 10(a)(2)(B) of the ESA. In order to issue a permit, the ESA requires:

- The taking will be incidental;
- The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking;
- The applicant will ensure that adequate funding for the conservation plan and procedures to deal with unforeseen circumstances will be provided;
- The taking will not appreciably reduce the likelihood of survival and recovery of the species in the wild; and,
- That measures required under section 10(a)(2)(A)(iv), if any, are met and such other assurances that may be required that the HCP will be implemented.

As a condition of receiving an ITP, an applicant must prepare and submit to the USFWS for approval an HCP containing the mandatory elements of section 10(a)(2)(A). An HCP must specify the following:

- The impact that will likely result from the taking;
- What steps the applicant will take to minimize and mitigate such impacts, the funding available to implement such steps, and the procedures to be used to deal with unforeseen circumstances;
- What alternative actions to such taking the applicant considered, and the reasons why such alternatives are not proposed to be utilized; and,
- Such other measures that the Secretary may require as being necessary or appropriate for the purposes of the plan.

The ESA Section 10 assessment will be documented in the respective section 10 findings document produced by the USFWS at the end of the process. If the USFWS makes the above findings, and all other criteria are satisfied, the USFWS will issue the ITP. In such cases, the USFWS will decide whether to issue the permit conditioned on implementation of the proposed HCP as submitted or to issue the permit conditioned on implementation of the proposed HCP as submitted together with other measures specified by the USFWS. If the USFWS finds that the above criteria are not satisfied, the permit request shall be denied.

1.3.1.2 ESA Section 7

Section 7(a)(2) requires all Federal agencies, in consultation with the USFWS, to ensure that any action "authorized, funded, or carried out" by any such agency "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification" of critical habitat. Because issuance of a section 10 ITP involves an agency authorization, it is subject to consultation under section 7 of the ESA. Although the provisions of section 7 and section 10 are similar, section 7 and its regulations introduce several considerations into the HCP process that are not explicitly required by section 10. Specifically included are indirect effects, effects on federally listed plants, and effects on critical habitat. The results of the ESA section 7 consultation are documented in a Biological Opinion produced at the end of the process.

1.3.2 National Environmental Policy Act

Issuance of an ITP is a federal action subject to NEPA compliance. The purpose of NEPA is to promote analysis and disclosure of the environmental issues surrounding a proposed Federal action in order to reach decisions that reflect NEPA's mandate to strive for harmony between human activity and the natural world. Although ESA and NEPA requirements overlap considerably, the scope of NEPA goes beyond that of the ESA by considering the impact of a Federal action on non-wildlife resources such as water quality, air quality, and cultural resources. Depending on the scope and impact of the HCP, NEPA requirements can be satisfied by one of the three following documents or actions:

- Categorical exclusion
- Environmental Assessment
- Environmental Impact Statement

Activities that do not individually or cumulatively have a significant effect on the environment can be categorically excluded from NEPA. An EA is prepared when it is unclear whether an EIS is needed or when the project does not require an EIS but is not eligible for a categorical exclusion. An EA culminates in either a decision to prepare an EIS or a Finding of No Significant Impact (FONSI). An EIS is required when the project or activity that would occur under the HCP is a major Federal action significantly affecting the quality of the environment, though an agency may produce an EIS at its discretion even in cases where significant effects are not likely to occur. An EIS culminates in a Record of Decision (ROD) that will be produced at the end of the process.

1.3.3 Migratory Bird Treaty Act

Under the Migratory Bird Treaty Act of 1918 (MBTA), as amended (16 U.S.C. §§703-712), taking, killing, or possessing migratory birds is unlawful. Birds protected under this act include most native songbirds, waterfowl, shorebirds, hawks, owls, eagles, ravens, crows, native doves, swifts, martins, swallows and others, including their body parts (feathers, plumes, etc.), nests, and eggs. A list of birds protected under MBTA implementing regulations is provided at 50 CFR §10.13.

Unless permitted by regulations, under the MBTA it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried, or received any migratory bird, part, nest, egg, or product. The MBTA provides no inherent process for authorizing incidental take of MBTA-protected birds and therefore the USFWS exercises discretionary prosecutorial authority in this respect where a wind farm demonstrates a good faith effort to avoid and minimize take of MBTA species. The Hawaiian petrel is protected under the MBTA. If the HCP is approved and USFWS issues an ITP to Auwahi Wind, the terms and conditions of that ITP will also constitute a special purpose permit under 50 CFR §21.27 for the take of the Hawaiian petrel under the MBTA. Therefore, any such take of the Covered Species will not be in violation of the MBTA.

On July 12, 2011, the USFWS reissued for public review Revised Draft Voluntary Land- Based Wind Energy Guidelines (USFWS 2011). These guidelines provide recommended approaches for assessing and avoiding impacts to wildlife and their habitats, including migratory birds, associated with wind energy project development. The USFWS continues to develop the guidelines based on public and agency input.

1.3.4 National Historic Preservation Act

Section 106 of the NHPA of 1966, as amended (16 U.S.C. §40 *et seq.*), requires federal agencies to take into account the effects of their actions proposed on properties eligible for inclusion in the National Register of Historic Places. "Properties" are defined herein as "cultural resources," which include prehistoric and historic sites, buildings, and structures that are listed on or eligible to the National Register of Historic Places. An undertaking is defined as a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency; including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; those requiring a federal permit, license or approval; and those subject to state or local regulation administered pursuant to a delegation or approval by a federal agency. The issuance of an ITP is an undertaking subject to Section 106 of the NHPA. Cultural and archeological resources surveys have been conducted for the Auwahi Wind project. The USFWS will coordinate with the State Historic Preservation Office for Section 106 compliance.

1.3.5 Executive Order 12898 – Environmental Justice

President Clinton issued Executive Order 12898 on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations on February 11, 1994. Executive Order 12898 requires federal agencies to take appropriate steps to identify and avoid disproportionately high and adverse effects of federal actions on the health and surrounding environment of minority and low income persons and populations. All federal programs, policies, and activities that substantially affect human health or the environment shall be conducted to ensure that the action does not exclude persons or populations from participation in, deny persons or populations the benefits of, or subject persons or populations to discrimination under such actions because of their race, color, income level, or national origin. The Executive Order was also intended to provide minority and low-income communities with access to public information and public participation in matters relating to human health and the environment.

The U.S. Environmental Protection Agency (EPA), working with the Enforcement Subcommittee of the National Environmental Justice Advisory Council, has developed technical guidance to ensure that environmental justice concerns are effectively identified and addressed throughout the NEPA process. The State of Hawaii has also developed its own legislation and guidance related to environmental justice. Act 294 was signed by Governor Lingle in July 2006 to define environmental justice in the unique context of Hawaii and to develop and adopt environmental justice guidance document that addresses environmental justice in all phases of the environmental review process (Kahihikolo 2008).

1.3.6 State and Local Plans and Policies

A number of additional state and local land use plans and policies govern the use of the area covered by the ITP. These include the following:

- HRS § 195D: Any species of aquatic life, wildlife, or land plant that has been determined to be a threatened or endangered species pursuant to the ESA is also considered to be threatened or endangered under the state law, and subject to the conditions of HRS § 195D-4. An ITL may be obtained from the DLNR to allow a take of a threatened or endangered species provided that (1) take impacts are minimized and mitigated; (2) the mitigation plan increases the likelihood that the species will survive and recover; (3) the project provides net environmental benefits; and (4) the take is not likely to cause the loss of genetic representation of an affected population of any endangered, threatened, proposed, or candidate plant species.

- HRS § 343: The Auwahi Wind project involves three activities that are triggers for compliance with HRS § 343: (1) use of state land, (2) use of county land, and (3) use of land classified as conservation district land. Project components that will require the use of these lands are the generator-tie line and the construction access route.
- The Hawaii State Plan serves as a guide for the long-range development of the state and provides a basis for determining goals, objectives, policies, and priorities for the state's limited resources. The Hawaii State Plan relies on implementing laws and regulations to achieve its goals.
- State of Hawaii Land Use Law (HRS § 205) established the State Land Use Commission that has the authority to designate all state lands into one of four districts: Urban, Rural, Agricultural, or Conservation. The Auwahi Wind project occurs on land classified as Agricultural District, except for two portions of Papaka Road classified as Urban District and Conservation District. Agricultural lands that coincide with the project have productivity ratings of E., C and D (Hawaii Office of Planning 2010). The Kahikinui Forest Project also occurs on Conservation District land. All land within the ATST mitigation area is unencumbered land owned by the State.
- State Conservation District Law (HRS § 183C): Land uses in the state Conservation District are under the sole jurisdiction of the state and are governed by HRS § 183C and the rules of the DLNR (HAR § 13-5). Conservation Districts, under the jurisdiction of DLNR, are further subdivided into five subzones: Protective, Limited, Resource, General, and Special. Portions of the project occur in Resource, General, and Protective subzones. Land uses in the Conservation District require a discretionary permit from DLNR.
- Hawaii Coastal Zone Management (CZM) Program (HRS § 205A-2) complies with the Federal Coastal Zone Management Act (CZMA) of 1972 (16 U.S.C. §§ 1451-1456). It is designed to protect valuable and vulnerable coastal resources. The area extending inland generally a minimum of 300 feet (ft) (91 meter [m]) from the shoreline to is considered as Special Management Area (SMA) regulated to ensure permitted activities are consistent with the objectives and policies of the CZMA and SMA guidelines. The County of Maui has regulatory control over development within the SMA and Shoreline Setback Area of the coastal zone. The entire wind farm site, including the portion of the generator-tie line that is in the footprint of the wind farm site, and approximately 1,500 linear ft of Papaka Road are in the SMA. No portion of the Auwahi Wind project or mitigation sites are located within the shoreline setback area of the Island of Maui and therefore are not subject to Chapter 12-203, Shoreline Rules for the Maui Planning Commission.
- The General Plan of the County of Maui (1990) serves as long-term, comprehensive planning "blueprint" for physical, economic, environmental development and cultural identity of Maui County. There are three tiers to the General Plan: the Countywide Policy

Plan; the Maui Island Plan; and nine Community Plans. The plan is now being revised as the General Plan 2030. Themes of this revision include making Maui County more self-sufficient by limiting the amount of non-renewable energy used.

- The Countywide Policy Plan (County of Maui 2010c) serves as an overarching policy document with broad goals, objectives, policies, and implementing actions.
- Maui Island Plan is a blueprint that provides direction for future growth, the economy, social, and environmental decisions on the island through the year 2030 (County of Maui 2010b).
- The Auwahi Wind project is within the boundaries of Maui County's Hana Community Plan, the Makawao-Pukalani Community Plan, and the Kihei-Makena Community Plan. Each plan provides recommendations to address goals, objectives, and policies in the County of Maui General Plan, as well as to guide decision making in its region of coverage.
- Portions of the Auwahi Wind project are located in the County Agricultural zoning district, and thus are subject to Maui County Code and County zoning regulations. The Auwahi Wind project is considered a Special Use, because it meets the definition of a major utility facility (Maui County Code Chapter 19.04.040). Therefore, the project would require a County Special Use Permit (CUP) from the Maui Planning Commission. An application for a CUP will be submitted to the County of Maui in compliance with the requirements of the Maui County Code.

2.0 PROPOSED ACTION AND ALTERNATIVES

Along with a discussion of the need for the proposal, an EA must contain a brief discussion of alternatives and the environmental impacts of the proposed action and alternatives (40 C.F.R. § 1508.9(b)). An EA must fully analyze a range of reasonable alternatives as well as alternatives that were eliminated from detailed study with a brief discussion of the reasons for eliminating them (CEQ § 1502.14). Possible action alternatives would consist of some modification of the HCP that may be required in order to issue the ITP or some modification of the ITP itself. Auwahi Wind has worked proactively with USFWS and the Hawaii Department of Forestry and Wildlife (DOFAW) to thoroughly analyze a full range of alternatives. The alternatives evaluated in detail below consist of the No Action (Alternative 1), the Proposed Action (Alternative 2), and a reduced permit term (Alternative 3). Two additional alternatives that were considered but not carried forward for further evaluation are discussed in Section 2.4.

2.1 ALTERNATIVE 1: NO ACTION ALTERNATIVE

Under the No Action Alternative, Auwahi Wind would not be granted the ITP. Without issuance of an ITP, Auwahi Wind could still construct and operate the Auwahi Wind project but would be potentially liable for prosecution under Section 9 of the ESA should take of a listed species occur. However, for the purposes of this analysis it is assumed that if the ITP were not granted the Auwahi Wind project would not be constructed or operated. Therefore, under this alternative, there would be no additional impact to the Covered Species as no project component would be built. The Ulupalakua Ranch would continue current operations and there would be no change to the existing on-site conditions, nor risk to the Covered Species associated with collision with WTGs or other project structures or from construction activities. Under the No Action Alternative, the HCP would not be implemented and, therefore, beneficial activities including protection, restoration, research, and monitoring would not occur.

2.2 ALTERNATIVE 2: PROPOSED ACTION

The Proposed Action is the issuance of an ITP under section 10(a)(1)(B) of the ESA, as requested by Auwahi Wind, and implementation of the Auwahi Wind project HCP. Under the Proposed Action the ITP issued by the USFWS would be valid for a period of 25 years. An HCP, submitted to the USFWS under separate cover, has been developed to support this alternative and to document Auwahi Wind's proposed plan to avoid, minimize and mitigate for impacts to the Covered Species to the maximum extent practicable. The take levels required under the Proposed Action are listed in Table 2.2-1.

Table 2.2-1. Requested ITP authorization for ESA-listed species under the Proposed Action.

Species	Requested Take Over the 25-year HCP Period
Hawaiian petrel	Tier 1: 19 adults; 7 chicks Tier 2: 32 adults; 12 chicks Tier 3: 64 adults; 23 chicks
Hawaiian hoary bat	Tier 1: 5 adults; 2 young Tier 2: 10 adults; 4 young Tier 3: 19 adults; 8 young
Hawaiian goose	5 adults
Blackburn's sphinx moth	6 acres

The following sections describe the covered activities and the conservation measures incorporated into the HCP.

2.2.1 Covered Activities

The ITP would cover construction, O&M of the Auwahi Wind project including a 21-MW wind farm, a 34.5-kV generator-tie line, and construction access route (Figure 1-2; see Section 2.2.2 for a detailed description). The Auwahi Wind project is located almost entirely on the Auwahi Parcel of the Ulupalakua Ranch, approximately 10 miles (16 km) south of Kula, in the Hana, Kula, and Kihei Districts of Maui. The ITP would also cover mitigation activities proposed on the Ulupalakua Ranch, as well as offsite in the Kahikinui Forest Project. Mitigation locations are described in detail below.

2.2.2 Description of the Auwahi Wind Project

The following subsections briefly describe the construction and O&M activities associated with each component of the Auwahi Wind project that would be covered under the ITP. Additional information on the project components and construction methods can be found in the Auwahi Wind project HCP (Tetra Tech 2011). This section also describes avoidance, minimization, and mitigation measures associated with construction and operation of the wind project for non-biological resources.

2.2.2.1 Wind Farm Site

The 1,466-acre (5.9 square km) wind farm site would be located on the southern portion of the Auwahi Parcel, bordered by the Pacific Ocean to the south and Upcountry Piilani Highway to north with state-owned undeveloped lands adjacent to the west and east of the site. The wind farm would include WTGs, access roads, an underground electrical collection system, an equipment staging and laydown area, operations and maintenance building, and one permanent met tower. The following describes each of these components (Figure 2-1).

Turbines – The Auwahi Wind project would involve the construction and operation of 8 Siemens 3.0-MW WTGs. This WTG model is a gearless direct-drive machine with a hub height of 263 ft (80 m) and a rotor diameter of 331 ft (101 m), resulting in a maximum height (height to the top of the blade) of 428 ft (130.5 m). The WTGs would be arranged in one north-south oriented string. Placement of WTGs was based on topography and intended to minimize impacts to environmental and archaeological resources. The WTGs would be marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting.

Turbine Pads and Foundations – Each WTG would require a graded and cleared area of approximately 2.4 acres (1.0 hectare [ha]) during construction for a crane pad and equipment laydown area. Forklifts, medium-size cranes (90 to 130 tons [82 to 118 metric tons]) and a main erection crane (as large as 600 tons [544 metric tons]) would be required for tower assembly and erection; construction equipment requiring access to these areas would include both wheeled and tracked vehicles. Cranes used to assemble the WTG components would be delivered to the wind farm site in multiple legal-weight loads. Each WTG foundation would be approximately 60 ft (18.3 m) wide by 8 ft (2.4 m) deep. Each WTG foundation would consist of approximately 350 cubic yards (268 cubic m) of concrete with reinforced bars and anchor bolts. Concrete is usually poured continuously and would require approximately 40 concrete trucks per foundation. Auwahi Wind anticipates that for each WTG pad, concrete deliveries and pouring would occur over a 2-day period

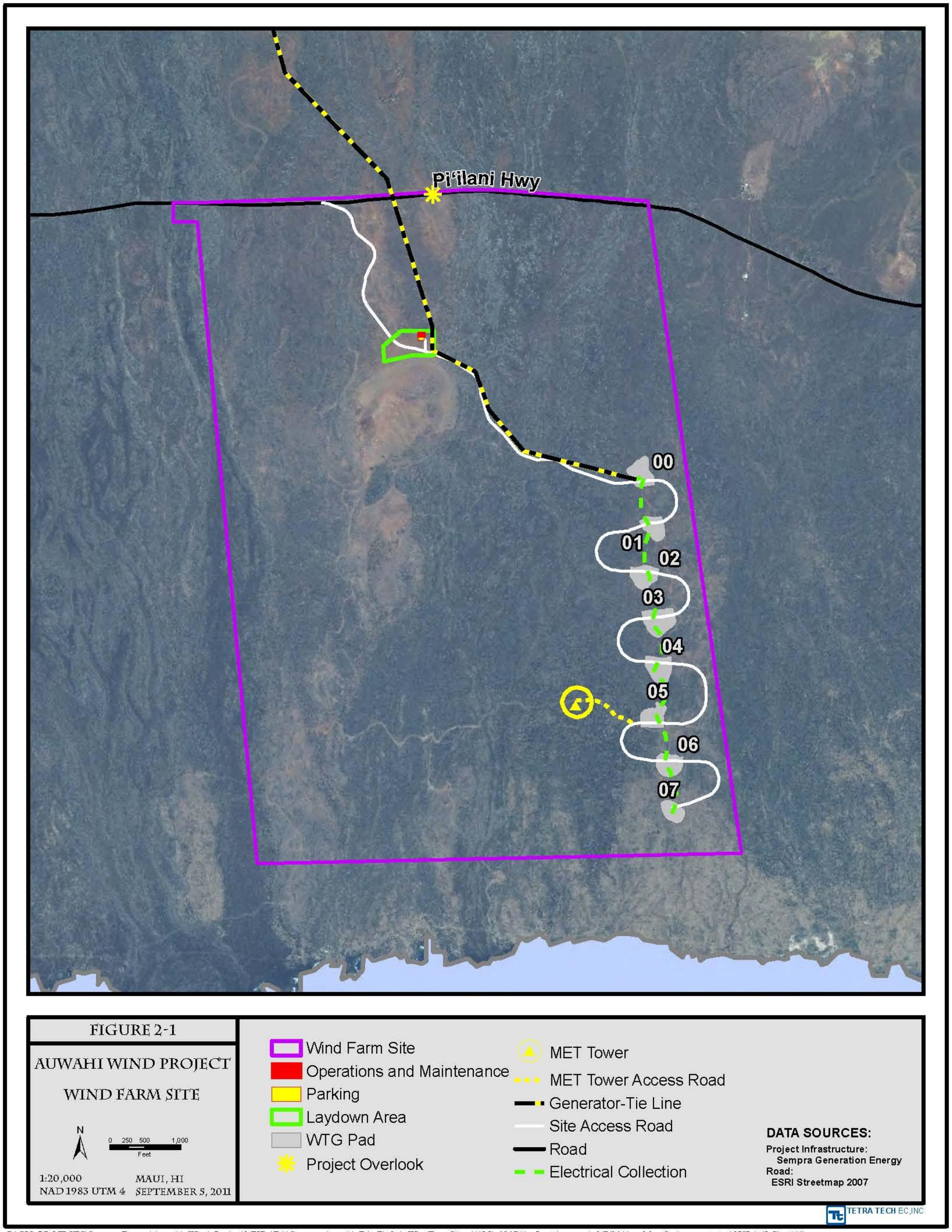


FIGURE 2-1

AUWAHI WIND PROJECT

WIND FARM SITE

P:\GIS_PROJECTS\Sempra_Energy\Auwahi_Wind_Project\MXDs\EA\Sempra_Auwahi_EA_Fig2-1_WindFarmSite_11i85i_090711 - Last Accessed: 9/7/2011 - Map Scale correct at: ANSI A (8.5" x 11") consisting of one 300 cubic yard (229 cubic m) pour followed by one 50 cubic yard (38 cubic m) pour. A graveled area around the permanent WTG pads of approximately 0.3 acres (0.1 ha) would be maintained during operation. Following construction, the cleared and leveled areas at the WTG pads would be reseeded with vegetation.

Each WTG would require multiple deliveries (at least 10 separate loads including 7 superloads) of equipment and materials to its pad. Towers are generally delivered in three or four sections, but each blade would be delivered separately, as would the nacelles and rotors and down-tower components (e.g., switchgear, controllers, ladders and platforms, pad-mount transformers, and pad-mount transformer vaults). Deliveries would be made using transport vehicles that conform to road weight limits; any variances would be incorporated into permits submitted to the Hawaii Department of Transportation (HDOT).

Access Roads – During operation turbine maintenance would be conducted with service vehicles; routine maintenance typically does not require heavy equipment, such as large cranes. However, in the event of a major component replacement (e.g., blades, gearboxes, or generators), heavy equipment similar to that used during construction, would be required. If a major component replacement were necessary, the access road (see below), crane pad, and staging area would be used in a similar manner as for the original assembly area, with similar disturbance and restoration.

A series of internal access roads would be constructed within the wind farm site to accommodate construction and maintenance activities (Figure 2-1). The internal access roads would be approximately 20 ft (6 m) wide with 9-ft-wide (3-m-wide) shoulders on each side (38 ft [12 m] total width) and approximately 3.6 miles (5.8 km) long. Shoulders may be expanded to 16 ft (5 m) wide in certain areas to allow for adequate passage for the crawler crane and transport trucks, and would include turn-around areas as certain WTG pad locations. The total temporary disturbance required during construction of the road would depend on the amount of cut-fill in any one area but would be greater than the width of the road and could expand to 138-ft- (42-m-) wide in certain defined areas. During operations, road widths would be maintained at 25 ft (7.6 m) to 38 ft (11.6 m) wide. All access roads would have a gravel surface and storm water collection and erosion control features, and would be maintained as such throughout construction and operation of the Auwahi Wind project.

Electrical Collection System – Power generated by each of the WTGs would be collected by a series of underground power cables (collection circuits). Low-voltage (690-volt [V]) cables would pass from the generator in each nacelle through the foundation to a pad-mounted transformer located adjacent to each WTG foundation. The transformer would step up the low-voltage power from 690 V to medium voltage power at 34.5 kV. The medium voltage power cables would "daisy-chain" between each pad-mount transformer. The cables would be directly buried in trenches and would terminate at riser structures located adjacent to the northernmost WTG pad location (Pad 00) and transition to the overhead generator-tie line. The electrical collection system would consist of a 34.5-kV feeder circuit. Each of the two riser structures (one for each circuit) would have a manual gang-operated disconnect switch that would allow each 3-phase circuit to be isolated from the generator-tie line. The trenches for the underground cables would be excavated by rubber tire or tracked equipment to the required burial depth, typically 36 inches (91 centimeters [cm]). Depending on the subsurface conditions, blasting may be required to install the trenches. Each trench would contain three power cables (one for each phase), plus a ground wire and a fiber optic communication cable for the supervisory control and data acquisition (SCADA) system (to transmit data from the WTG controllers to the interconnection substation and O&M building). The cable trench would be backfilled with select fill material to protect the cables from damage or possible contact and to provide appropriate media for heat dissipation from the cables. It is estimated that approximately 3 acres (1.2 ha) of temporary ground disturbance would be necessary to construct the underground electrical collection system.

Following construction, the collection system trenches would be restored and replanted with vegetation. Using small trucks, qualified personnel would routinely monitor, inspect, and maintain the communication and electrical collector cables throughout the O&M phase of the project. Heavy construction or excavation equipment would only be required if any underground cables were determined to have failed.

Construction Staging and Laydown – A construction staging and equipment laydown area would be built and used for temporary storage of plant equipment, construction materials and equipment, vehicle parking and refueling, water storage, waste disposal and collection receptacles, sanitary facilities, and temporary modular office space. The staging and laydown area would consist of an approximately 4.9-acre (2.0-ha) compacted gravel pad Figure 2-1). Refueling of construction vehicles would take place onsite using a vendor-supplied fuel truck or skid-mounted tanks on pick-up trucks. Fuel stored onsite would be provided with secondary containment. Following construction, gravel would be removed from the temporary construction staging and laydown area and most of the area would be revegetated with native vegetation and pasture grasses. A permanent area of approximately 0.2 acre (0.8 ha) within the laydown area would be retained to serve as the location of the O&M building and as a storage location for spare WTG components, such as blades.

Operations and Maintenance Building – An O&M building would be located within the laydown area. The building footprint and concrete slab would be approximately 50 ft by 80 ft (15 m by 24 m), an area of 0.1 acre (0.04 ha). With parking and outdoor storage, the area of permanent disturbance would be approximately 0.2 acres (0.08 ha).

Meteorological Tower – One permanent met tower or two temporary met towers would be installed to measure and record weather data to track the performance of the WTGs. Met towers would have a height of 262 ft (80 m), guy radius of 208 ft (63 m), and a tower rating of 80 miles per hour (mph) (129 kilometers per hour [kph]) wind speed. Meteorological data include wind speed and direction, barometric pressure, humidity, and ambient temperature. This equipment would be used by the wind farm operator to monitor and actively assess project performance. Either a lattice tower or a monopole tower would be installed. For determining impacts, a conservative approach for the permanent guyed met tower (fitted with bird diverters and white, 1-inch [2.5-cm] poly tape) would be to assume a circular area with a 210-ft (64-m) horizontal radius (guy radius). This would be a maximum total impact area of approximately 3.1 acres (1.2 ha), of which 0.2 acres (0.1 ha) would be permanently impacted. Construction of the permanent met tower would require site preparation (e.g., clearing and grubbing); grading; installation of a foundation, underground electrical and communication lines; and onsite assembly of the tower. Disturbance for the temporary met towers has already been accounted for in disturbance areas for other project components.

2.2.2.2 Generator-tie Line and Interconnection Substation

An approximately 9-mile (15-km), 34.5-kV generator-tie line and an interconnection substation would be constructed to facilitate the connection of the wind farm to the MECO electrical grid system. The generator-tie line would originate within the wind farm site and extend north and west on Ulupalakua Ranch property, crossing both Upcountry Piilani Highway and Kula Highway to connect to the existing MECO Wailea-Kealahou 69-kV transmission line at the proposed point of interconnection located approximately 1 mile (1.6 km) east of MECO's Wailea substation.

Generator-tie Line – The generator-tie line facilities would be constructed using wood poles. The poles would support the two three-phase 34.5-kV generator-tie line (i.e., six conductors), associated insulators and accessories, and an optical ground wire (OPGW). All the required poles would be within the established corridor, approximately 60 ft (18 m) wide and 9 miles (14.5 km) long. The poles are anticipated to be approximately 60 ft (18 m) tall, similar to the existing wood poles supporting MECO's Wailea-Kealahou transmission line. Taller poles may be required along a small section of the generator-tie line (less than 1,000 ft [305 m]) if it is necessary to span a Fresnel (beam) zone along the alignment. These structure heights could approach approximately 100 ft [31 m]. Final structure heights will be determined as part of detailed engineering and design. Poles with guy wires would only be used at inflection points along the generator-tie line and are expected to be less than 10 percent of the overall poles. The exact location of each pole would be determined based on detailed engineering that would take into consideration a variety of factors, including existing access roads, terrain, environmental constraints, and cost. Temporary disturbance associated with the generator tie-line would be approximately 63.0 acres (25.2 ha). Permanent disturbance associated with generator-tie line structures would be approximately 2.0 acres (0.8 ha).

The generator-tie line would have a height at or below 60 ft (18 m) above the ground (height of the poles with lines sagging between poles). Conductors will be arranged vertically, such that the static ground wire will be positioned above the generator-tie line. The generator-tie line would be designed to minimize the potential for collision by birds by fitting an approximately 1.6 mile (1.0 km) stretch identified as having the highest collision risk with bird flight diverters.

Generator-tie line construction would utilize standard industry procedures including surveying, corridor preparation, materials hauling, pull sites, staging areas, structure assembly and erection, ground wire, conductor stringing, cleanup, and revegetation. Specific methods of access have not been determined but they would maximize use of existing ranch roads or areas suited for off-road driving to the extent possible to minimize impacts. During operations, qualified personnel would routinely monitor, inspect, and maintain the generator-tie line facilities using off-road vehicles and light trucks. Heavy construction equipment would only be required if overhead facilities need to be repaired or replaced.

69-kV Interconnection Substation – The substation would be located approximately 1.6 miles (2.6 km) south of Kula Highway. An area of approximately 6.4 acres (2.6 ha) would be cleared and graded during construction of the substation pad, below-grade raceway (e.g., the conduit, ductbank, and trench) and ground grid. The substation area would include the BESS that consists of batteries, inverters, step up transformers, and a control system to meet HECO performance requirements. Following installation of all equipment, a final layer of crushed rock surfacing would be placed and a perimeter fence would be erected and grounded. The fenced dimension of the interconnection substation would be approximately 5.0 acres (2.0 ha). The substation would be shared by Auwahi Wind and MECO.

Vehicle access to the substation would be provided on the east and north sides from Kula Highway. To the maximum extent possible, the access road to the interconnection substation would follow existing ranch roads. The existing ranch roads and proposed newly constructed portions would be 20 ft (6.1 m) wide with a maximum grade of 15 percent and a minimum turning radius of 100 ft (30.5 m) so that a truck similar to a WB-62 carrying transformers could access the site. Approximately 16.3 acres (6.5 ha) would be disturbed during construction of the substation access road, of which 4.2 acres (1.7 ha) would be permanently impacted. The road would have an all-weather graveled surface with adequate compaction to accommodate the specialized transportation equipment. The road would be designed to adequately collect storm water runoff and minimize erosion.

During operations, maintenance would include routine inspections of each component and monitoring of equipment and electronics according to the manufacturer's recommendations and owner's requirements, and in accordance with regulatory requirements. Routine maintenance of the interconnection substation would not typically require heavy construction equipment. However, if a major component failure occurred (e.g., a failure of a main transformer) then appropriate construction equipment would be required to replace the component.

2.2.2.3 Construction Access Route

An approximately 27-mile (44-km) construction access route would be required for the transportation of equipment from Kahului Harbor, the island's only commercial port, to the proposed wind farm site. The construction access route would primarily follow existing state and county highways as well as approximately 4.6 miles (7.4 km) of pastoral roads between Makena Alanui Road and Upcountry Piilani Highway. These pastoral roads are collectively referred to as Papaka Road and are located on Ulupalakua Ranch and several other private and publicly owned parcels. The construction access route consists of two routes which will share the traffic burden association with construction of the project. The Papaka Route extends from Kahului to the Mokulele Highway, through Kihei, Wailea, and Makena, and along Upcountry Piilani Highway to the wind farm site. The Kula Route, a more direct route from Kahului Harbor, uses Haleakala and Kula highways. Several portions of the Kula Route do not have dimensions or weight limits adequate for the size of transport truck required for hauling turbine components; however, this route is suitable for other construction vehicles such as worker vehicles, dump trucks, and typical semi-trucks.

Because most of the major turbine components are considered "superloads," special transportation equipment (e.g., multi-axle transport trailers, Schnabel trailers with hydraulic lifts, and steerable blade-trailers) would be required. To accommodate these superloads, portions of Upcountry Piilani Highway (commonly referred to Kula Highway in this area) and Papaka Road would require permanent modifications. Permanent roadway modifications would include widening or smoothing in places, trimming of vegetation, and construction of new road segments to keep the alignment on Ulupalakua Ranch property. Approximately 50.6 acres (20.4 ha) would be impacted during construction in association with road modifications, of which 11.2 acres (4.5 ha) would be permanently impacted. Temporary road improvements would also be necessary at some intersections and these would all occur within the existing road bed.

2.2.2.4 Site Clean-Up

All portions of the Auwahi Wind project would be maintained in an orderly and clean manner throughout construction. At the completion of the construction phase, a final cleanup of all construction areas would be done. All construction-related waste would be properly handled in accordance with county, state, and federal policies and permit requirements and removed from the area for disposal or recycling as appropriate. Areas with disturbed soil that would not be used during operations would be stabilized and returned to cattle grazing.

2.2.2.5 Decommissioning and Restoration

The Auwahi Wind project has an estimated 20-year life based on the projected useful life of the WTGs. After that time, Auwahi Wind would evaluate whether to continue operations of the project or decommission it. Should the period of project operation be extended, the facility would be upgraded and repowered with renegotiated leases (and any necessary extensions of project permits and approvals, such as the ITP and ITP, would need to be obtained). If the project was decommissioned, the goal of decommissioning would be to remove the power generation equipment and return the site to a condition as close to its pre-construction state as possible within 2 years as contractually required in both the Land Lease with Ulupalakua Ranch and the Power Purchase Agreement with Maui Electric. For modern wind farms, the scrap value of the equipment is substantially greater than the cost of decommissioning and removal, however, Auwahi Wind would provide either a parent guarantee or a letter of credit to support the decommissioning plan for the project. All decommissioning- and restoration-related waste would be properly handled and disposed of or recycled, as appropriate, in accordance with county, state, and federal laws and permit requirements. Foundations would be removed to a depth below grade, and roads would be left for use by the Ulupalakua Ranch. Major activities required for decommissioning would typically occur in reverse order to those of construction and are listed below:

- WTG foundation and met tower removal. Concrete and steel would be hauled offsite. Foundations would be filled with native weed-free aggregate and soils;
- Electrical collection system removal for above-ground structures and decommissioning in place for below-ground cables;
- Sale or demolition of the O&M building. The on-site septic system would be abandoned consistent with state and local requirements, unless needed for a future use of the site;
- Generator-tie line removal. Foundation holes would be filled with native weed-free soil;
- Road removal (as required by permit and/or site control agreements by landowners). Road disturbances would be re-graded to original contours where cut and fill made recontouring feasible. Any roads left in place would become the responsibility of the landowner;
- Grading disturbed areas to preconstruction contours where feasible;
- Revegetation with native or pasture grass species to ensure establishment of vegetation. Where applicable, restored areas would be stabilized and returned to cattle grazing; and
- Recycling and disposal of materials, WTG components, and any hazardous and regulated materials and wastes would be conducted per applicable local, state, and federal regulations.

Decommissioning would restore the visual and ecological character of the landscape and also remove effects to other environmental and public resources that may have occurred as a result of project operations.

2.2.3 Conservation Measures Proposed in the HCP

Auwahi Wind has worked collaboratively with the USFWS and DOFAW to assess the potential for the Auwahi Wind project to cause adverse effects to the Covered Species. The HCP identifies goals and objectives for each Covered Species that establish a framework for developing the HCP conservation strategy, as outlined in the USFWS Five-point Policy guidance for the HCP process (USFWS and NMFS 2000). The biological goals and objectives for the Hawaiian petrel, Hawaiian goose, and Hawaiian hoary bat are species-based because the proposed project is anticipated to directly or indirectly affect individuals through collisions with project facilities, but would have no (petrel) or negligible (bat and Hawaiian goose) impacts on the amount or quality of their terrestrial habitats. The biological goals and objectives for the Blackburn's sphinx moth are both habitat- and species-based. For the moth, the proposed project has the potential to indirectly affect this species through impacts to its host plants and it could cause direct harm to larvae during construction.

2.2.3.1 Avoidance and Minimization Measures for Covered Species

Auwahi Wind has incorporated measures to avoid and minimize take of the Covered Species that are identified below including construction timing considerations, pre-construction surveys, selection of project components, and micrositing considerations.

Project Development Measures

General

- A daytime speed limit of 25 mph (40 kph) and a nighttime speed limit of 10 mph (16 kph) will be observed on project area roads to minimize the potential for vehicle collisions with Covered Species.
- Truck and heavy-equipment traffic will be limited to existing disturbed areas as much as possible.
- The spread of invasive, non-native plant species caused by project construction will be minimized through cleaning and inspecting equipment coming to the site, and by replanting disturbed areas with native species or pasture grasses to be compatible with continued grazing. (See Appendix A for a list of potential species.)
- Trash, especially food stuffs, will be removed from the construction area on a weekly basis to avoid attraction of ants and other animals such as mongooses, cats, and rats that may negatively affect the Covered Species. Adaptive management will be utilized to assess the need for modifications to trash removal. Auwahi Wind will utilize best management practices for the usage and servicing of trash containers.
- A project biologist will be on-staff during project operations to conduct post-construction monitoring surveys, to assist with mitigation measures, and to address any potential wildlife issues that may arise.

Pre-construction Surveys and Timing Considerations

- Prior to any construction activities, threatened or endangered plant species within or adjacent to the project footprint will be protected with enclosures and impacts to individual listed plants will be avoided (see Appendix B for results of baseline surveys).
- To minimize impacts to Blackburn's sphinx moth habitat, the native host plant, aiea (*Nothocestrum latifolium*), within the project footprint will be fenced and avoided during construction. Maiapilo and moon flower, both moth food plants, that can be avoided within the areas of disturbance will also be flagged and temporarily fenced during construction.
- A survey and relocation plan for the Blackburn's sphinx moth, based on USFWS and DOFAW protocol, will be implemented by a qualified entomologist. Pre-construction clearance surveys will be conducted 90 days prior to the start of construction for Blackburn's sphinx moth adults and larvae. These surveys will identify and map plants in the Solanaceae family (i.e., tree tobacco, the plant species Blackburn's sphinx moths are most commonly associated with) and those plants with Blackburn's sphinx moth or larvae within the project area. Unoccupied solanaceous plants will be removed to prevent future use by the

Blackburn's sphinx moth. Should any larvae or moths be found just prior to construction, the larvae and moths will be removed and relocated by the authorized entomologist to an approved nearby location outside the area of disturbance that contains suitable moth habitat to avoid direct take. These occupied areas will be flagged and avoided during construction until the moth or larvae can be relocated. The pre-construction surveys and associated plant removal/moth relocation will help to reduce the likelihood of the Blackburn's sphinx moth occurring in the project area during construction and ultimately the potential direct take from ground disturbance during construction.

- Auwahi Wind will maximize the amount of construction activity that can occur in daylight during the seabird breeding season to minimize the use of nighttime lighting that could be an attraction to seabirds. Construction at night would be necessary for small time periods (i.e., a few hours) in the event that high winds above 25 mph (40 kph) during daytime hours prohibit safe turbine erection. The need for erecting the turbine towers at night will be determined by Auwahi Wind and is anticipated to be infrequent and restricted to the period of September to December 2012. Additional limited project activities, such as the transportation of some project equipment and the pouring of concrete pads, may occur at night as well to minimize daytime construction traffic, but will be kept to a minimum. Each turbine foundation will require 1 day to pour the concrete; a total of 8 days spaced throughout May to August 2012. In instances where nighttime construction is unavoidable, lighting will be limited to one tower at a time, providing that doing so does not compromise worker safety. An environmental monitor will be onsite during those periods of night construction. If the monitor observes that any Covered Species are being attracted to the construction lighting, such lighting will be turned off as soon as it is safe to do so. In the unlikely event that construction lighting results in the grounding of Covered Species, the monitor will retrieve and assist such individuals in accordance with the Downed Wildlife Protocols.
- Hawaiian hoary bats roost in non-native and native woody vegetation that is at least 15 ft (4.5 m) or taller. To minimize potential impacts to the Hawaiian hoary bat, woody plants greater than 15 ft (4.5 m) tall will not be removed or trimmed between June 1 and September 15 during the installation and ongoing maintenance of the project structures. Disturbance of trees or shrubs suitable for bat roosting will be minimized during the April through mid-May early period of the bat breeding season. The primary area of concern for the project is the portion of the generator-tie line in the area between the Natural Area Reserve (NAR) and Auwahi Forest Restoration Project.

Project Components and Siting Considerations

- At the time of installation, the permanent met tower guy wires will be fitted with bird flight diverters and white, 1-inch wide [2.5-cm] poly tape, to increase visibility and subsequently increase the likelihood of avoidance by the seabirds and bats. This tape has proven effective in minimizing petrel collisions on other projects within the Hawaiian Islands when wrapped on the guy wires (Hodges and Nagata 2001; Tetra Tech 2008a). Flagging will be used to minimize perching should a lattice tower model be installed.
- The wind farm is sited in an area with limited forested areas to avoid potential impacts to bat roosting habitat.

- The proposed WTG model has significantly slower rotational speeds (6 to 16 revolutions per minute [rpm]) compared to older designs (28.5 to 34 rpm). This increases the visibility of turbine blades during operation and decreases collision risk (Thelander et al. 2003). Additionally, the selection of the 3.0-MW Siemens model results in the least ground disturbance because only 8 turbines will be installed compared to the other turbine models considered that would require 15 or 10 turbines.
- An FAA endorsement of a minimal lighting plan has been requested to reduce the likelihood of attracting or disorienting seabirds, bats, and insects.
- To minimize potential impacts to wildlife, onsite lighting at the O&M building and substation will consist of fixtures that will be shielded and/or directed downward and triggered by a motion detector, thereby avoiding lighting situations where light glare projects upward or laterally. These lights will be utilized only when workers are at the site at night.
- The proposed substation and interconnect to MECO's transmission lines will be designed and installed using industry-standard measures to reduce the possibility of wildlife collisions by fitting bird flight diverters on the generator-tie line in high risk areas. Based on site-specific design work conducted to date, the maximum height of the generator-tie lines is expected to be 65.5 ft [20 m] above ground level, which should reduce the potential for collision by seabirds.
- The measures described in this chapter for Covered Species will also avoid and minimize impacts to MBTA-protected species to the extent possible. Auwahi Wind has committed to implementing a post-construction monitoring program to assess project-related impacts to avian species and would use the results of this monitoring to ensure that impacts to MBTA-protected species are avoided and minimized to the extent possible. Additionally, the mitigation measures for the Hawaiian hoary bat, Hawaiian petrel, and Blackburn's sphinx moth (Section 2.2.3.2) that would protect and/or restore native habitats would also benefit migratory bird species. Thus, the HCP's conservation strategy will be a significant benefit to all migratory bird species potentially impacted by the Auwahi Wind project. Therefore, the Auwahi Wind project is consistent with the requirements of the MBTA.
- Iliahi and red ilima are the only listed endangered plant species documented during botanical surveys. Prior to construction, additional botanical surveys will be conducted to identify any occurrences of these or any other listed plant species in areas proposed for development based on the final project design. These plants will be fenced and avoided during construction.
- The listed plant species that occur within the Auwahi Wind project vicinity are known to occur in dryland forests on Maui including within the nearby Auwahi Forest Restoration Project and the lower elevations of the Kahikinui Forest Project. Mitigation measures described in Section 2.2.3.2 at the Waihou Mitigation Area (Hawaiian hoary bat) and Auwahi Forest Restoration Project (Blackburn's sphinx moth) will also benefit special status and rare plants that occur in the vicinity of the Auwahi Wind project by protecting and/or restoring native vegetation communities.
- The project has been designed to avoid impacts to listed and candidate plant species. The fence enclosures to be installed around each aiea, iliahi, and red ilima adjacent to project disturbance areas will increase the long-term viability of each plant and provide protection

from ungulates that would not otherwise occur. Therefore, there are no direct impacts to these plants and mitigation for direct impacts is not needed. The USFWS is concerned that the project will, however, affect existing lands which hold the potential for supporting listed species in the future. The current and planned management of these areas in the absence of the project is expected to continue as pastureland, a condition that does not provide suitable habitat for the listed plants. However, because USFWS determined that a small potential exists that these lands could otherwise support listed plants at some point in the future, Auwahi Wind will implement conservation measures. Based on these minimal potential future impacts within the degraded lands, Auwahi Wind will plant a total of 10 additional plants for each species (aiea, iliahi, and red ilima). The Auwahi Forest Restoration Project includes the plantings of aiea and iliahi and therefore will benefit these species directly. As part of the Blackburn's sphinx moth mitigation (Section 2.2.3.2), 250 outplantings of aiea per restored acre will be installed at the Auwahi Forest Restoration Project (6 acres). Because this number of plants far exceeds the number requested by USFWS, there is no need for additional outplantings of this species. The Auwahi Forest Restoration Project may also outplant iliahi in that same acreage and will, as a result of this project, include 10 plants. As part of its ongoing conservation efforts, the Ulupalakua Ranch is working on a propagation effort for red ilima; 10 ilima from this project will be outplanted and fenced on the ranch to offset potential project impacts.

Invasive Plant Species Management

Auwahi Wind will work actively to minimize and reduce the ingress of certain undesirable invasive plant species such as fireweed (*Senecio madagascariensis*), a pasture weed that is highly toxic to grazing livestock and quick to recolonize disturbed areas. Auwahi Wind intends to implement measures to minimize and avoid the introduction of invasive species to Ulupalakua Ranch including:

- All equipment, materials, and vehicles brought onto the site during construction will be cleaned and inspected to prevent the introduction of invasive or harmful non-native species. An inspection station will be located at the staging area close to Piilani Highway.
- To minimize the introduction and spread of invasive plant species, potential off-site sources of materials (e.g., gravel, fill) will be inspected, and the import of materials from sites that are known or likely to contain seeds or propagules of invasive species will be prohibited.
- Vehicle operators transporting materials to the project site from off site will be required to follow protocols for removing soils and plant material from vehicles and equipment prior to entry onto the site.
- The Hawaii Department of Agriculture and Maui Invasive Species Commission will be consulted to establish protocols and training orientation methods for screening invasive species introductions during construction.
- As part of the fire management plan, Auwahi Wind will conduct surveys for invasive species of fire-prone grasses, with an emphasis on barbed wire grass and fountaingrass (*P. setaceum*). The survey extent will include, at a minimum, areas within 33 ft (10 m) of disturbance resulting from construction within the wind farm site, the interconnection substation site, and within roadways constructed or utilized more than once monthly for wind farm construction or maintenance. Individuals or colonies observed will be exterminated by Auwahi Wind Energy via a means that includes killing the root system.

Fire Prevention During Construction and Operation

- Fire risk associated with generator-tie line construction and operation is very low. The area of concern is along the pinch point corridor between the State NAR land and the Auwahi Forest Restoration Project, due to the presence of native vegetation. However, the probability of a fire in this 1.5-mile (2.4 km)-long area is approximately 0.05 percent over the lifetime of the Auwahi Wind project (see the Fire Management Plan in Appendix C of the HCP). Downed generator tie-lines represent an ignition threat, which usually stems from a weather event that causes degraded wood poles to blow over in high winds, or from a hazard tree coming into contact with the line itself. In addition to downed lines, poorly maintained lines can produce sparks and arcing that may cause a fire ignition in rare cases. Thus, design and maintenance are keys to the integrity of the line.

  The generator-tie line would consist of a vertically arranged three-phase 34.5-kV line (i.e., 6 conductors), designed and constructed according to industry standards. As configured the line is capable of carrying the entire wind farm output. During normal operations, assuming full output from the wind farm, only half of the plant output will be carried on each individual circuit. Under these conditions the current flow on each circuit will be approximately 211 Amperes and the associated conductor temperature will be 132 degrees Fahrenheit (°F), far below the design temperature criteria of 212 °F for calculating line clearances. Therefore, the generator-tie line will easily maintain the minimum required 18.5-ft (5.6-m) ground clearance under maximum line sag conditions at 212 °F. Consequently, there should be no issue with line conductors sagging down towards the ground and starting a fire based on the National Electric Safety Code (NESC) design for this line. In the unlikely event that the full plant output of 24 MW is carried on a single circuit, current flow would be 423 Amperes and conductor temperature would be 171 °F, also well below the design criteria of 212 °F. With full wind farm plant output on only one of the two circuits, the single circuit would load within 80 percent of the maximum design rating, which is a typical engineering design standard. It is important to note that design calculations are based on wind speed of 2 ft per second (0.6 m per second) or 1.62 mph (2.61 kph) and 104 °F ambient temperature assumptions. In reality, the line will be fully loaded only when wind speeds are above 29 mph (47 kph), so there will be a significant natural cooling effect to reduce conductor temperature even further below the calculated value of 171 °F at 1.36 mph (2.62 kph). This effect is one of the benefits of loading a generator-tie line for a wind project.

  Auwahi Wind will incorporate measures to address extreme wind design conditions. Although the line voltage is 34.5 kV, Auwahi Wind would use one class higher insulators (69 kV) for added strength and shorten the span lengths between poles to withstand severe weather conditions and strong wind uplift forces due to undulating topography near the line. The benefit of higher rated insulators will be greater arcing and leakage distance to counteract salt contamination, soiling (i.e., build up on exterior of the insulator due to dust or pollution), and provide greater horizontal conductor separation to reduce the source of ignition (electrical faults). Basically, the design of the generator-tie line will reduce the risk of fire because the line will be normally operated with each circuit carrying only half of the full wind farm output and be structurally designed to meet or exceed NESC requirements and withstand extreme weather conditions.

  To further reduce the very low risk of fire during construction and operations, Auwahi Wind will implement the measures outlined in the Fire Management Plan (Appendix C of the HCP) and conduct regular maintenance of the generator-tie line and the turbines.

- A scheduled maintenance system will be implemented by Auwahi Wind during project operations as a repository of key information about fire prevention activities associated with the generator-tie line. This system will be used and updated by O&M personnel who are trained in fire management practices. The system will also maintain records of best practices in fire prevention. One way to improve fire prevention performance over the long term is to adopt practices that have proven to be valuable and effective elsewhere in the industry and can be applied to the project.
- The generator-tie line poles will be inspected regularly to determine if there is any degradation or structural problem preventing them from withstanding high winds. As part of the Fire Management Plan, trained personnel will maintain the generator-tie line conductors and remove any overhanging limbs or trees, as necessary, to prevent branches from falling onto the power line. However, most of the generator-tie line traverses pasture.
- Generator-tie line insulators will be maintained as needed. Furthermore, vegetation will be maintained at least 16 ft (5 m) away from the conductors in all directions (radius of 16 ft (5 m) around the conductors). Most of the generator-tie line traverses pasture. Brushing or brush removal around the base of the poles is a precautionary measure to prevent fires from starting or keep them from spreading and affecting the integrity of wood pole structures along the generator-tie line. Furthermore, regular grazing by cattle is an integral part of the fuel management approach.

- Auwahi Wind is part of a $1 billion wildfire liability insurance program through its parent corporation, Sempra Energy. The insurance coverage not only pays for bodily injury and repair/replacement of the dwellings and personal property of third parties but also pays for replanting and refurbishing of vegetation that is damaged by wildfires caused by the legal liability of Auwahi Wind in the operations of the Auwahi Wind project.
- Fire risk associated with WTG operation is very low and will be prevented by the design features of the turbine model selected. The direct drive design of the Siemens 3.0-MW turbine eliminates the gearbox and therefore the need for gearbox lubricating oil inside the nacelle. Therefore, this WTG design has no risk of gearbox-related fires.

2.2.3.2 Mitigation Measures for Impacts to Covered Species

Auwahi Wind's proposed mitigation measures are designed to offset or compensate for the actual effects of unavoidable incidental take of Covered Species that occurs under the HCP. Auwahi Wind has worked with USFWS, DOFAW, and the Endangered Species Recovery Committee (ESRC) to identify appropriate mitigation measures to compensate for the take of the Covered Species. The ESRC is an appointed group, created by the state, which must approve the final HCP before an ITL can be issued by DOFAW/DLNR. ESRC members include representatives of the USFWS, DOFAW, the U.S. Geological Survey Biological Resources Division (USGS-BRD), the University of Hawaii Environmental Center, and other professionals with expertise in the area of conservation biology.

The mitigation proposed consists of a three-tiered approach for the Hawaiian hoary bat and Hawaiian petrel. For these species, initial mitigation efforts are designed to compensate for take at the Tier 1 authorized take level. Only one mitigation level is presented for the Hawaiian goose and Blackburn's sphinx moth due to the low anticipated level of take.

The mitigation measures outlined in Table 2.2-2 are intended to be complementary to other management activities that may be taking place for the benefit of the Covered Species. Over the term of the ITP, mitigation measures may be subject to modification by Auwahi Wind, with approval from the USFWS and DOFAW and in accordance with the Amendment procedures in Section 9 of the HCP, depending on the measured levels of take and the mitigation measures implemented. Should the net benefit provided by the mitigation implemented for a tier level exceed what was needed for that level of take (e.g., petrel mitigation at Tier 1 produces more than 19 adults and 7 chicks), the additional net benefit from the mitigation will be incorporated into the mitigation planning for the next higher tier if reached; all take will be mitigated. The following discussion describes the mitigation locations; the mitigation activities for each of the Covered Species and the rationale for their selection; and the details associated with implementing the mitigation specific to each Covered Species to aid in the assessment of their environmental impacts.

Table 2.2-2. Proposed mitigation for incidental take of covered species.

Covered Species	Tiered or One-Time	Tier 1 or One-Time	Tier 2	Tier 3
Hawaiian hoary bat	Tiered	Implement at Waihou Mitigation Area. Bat habitat restoration measures include fencing, ungulate removal, and outplanting.	Radio telemetry research study.	Use research to evaluate appropriate mitigation – additional area for bat habitat restoration available at Waihou Mitigation Area.
Hawaiian petrel	Tiered	Implement petrel management measures including conducting predator control and monitoring at the Kahikinui Forest Project.	Implement additional petrel management measures at the Kahikinui Forest Project or other appropriate management program.	Implement additional petrel management measures at the Kahikinui Forest Project or other appropriate management program.
Hawaiian goose	One-time	Funding to conduct predator control or support egg and gosling rescue at Haleakala National Park.	NA	NA
Blackburn's sphinx moth	One-time	Funding to the LHWRP to restore dryland forest in the Auwahi Forest Restoration Project including outplantings of larval and adult host plants.	NA	NA

LHWRP – Leeward Haleakala Watershed Restoration Partnership

Mitigation Locations

There are three locations where mitigation for the Covered Species would occur, including the Auwahi Forest Restoration Project (Blackburn's sphinx moth), the Waihou Mitigation Area (Hawaiian hoary bat), and the Kahikinui Forest Project (Hawaiian petrel) (Figure 2-2). Each of these

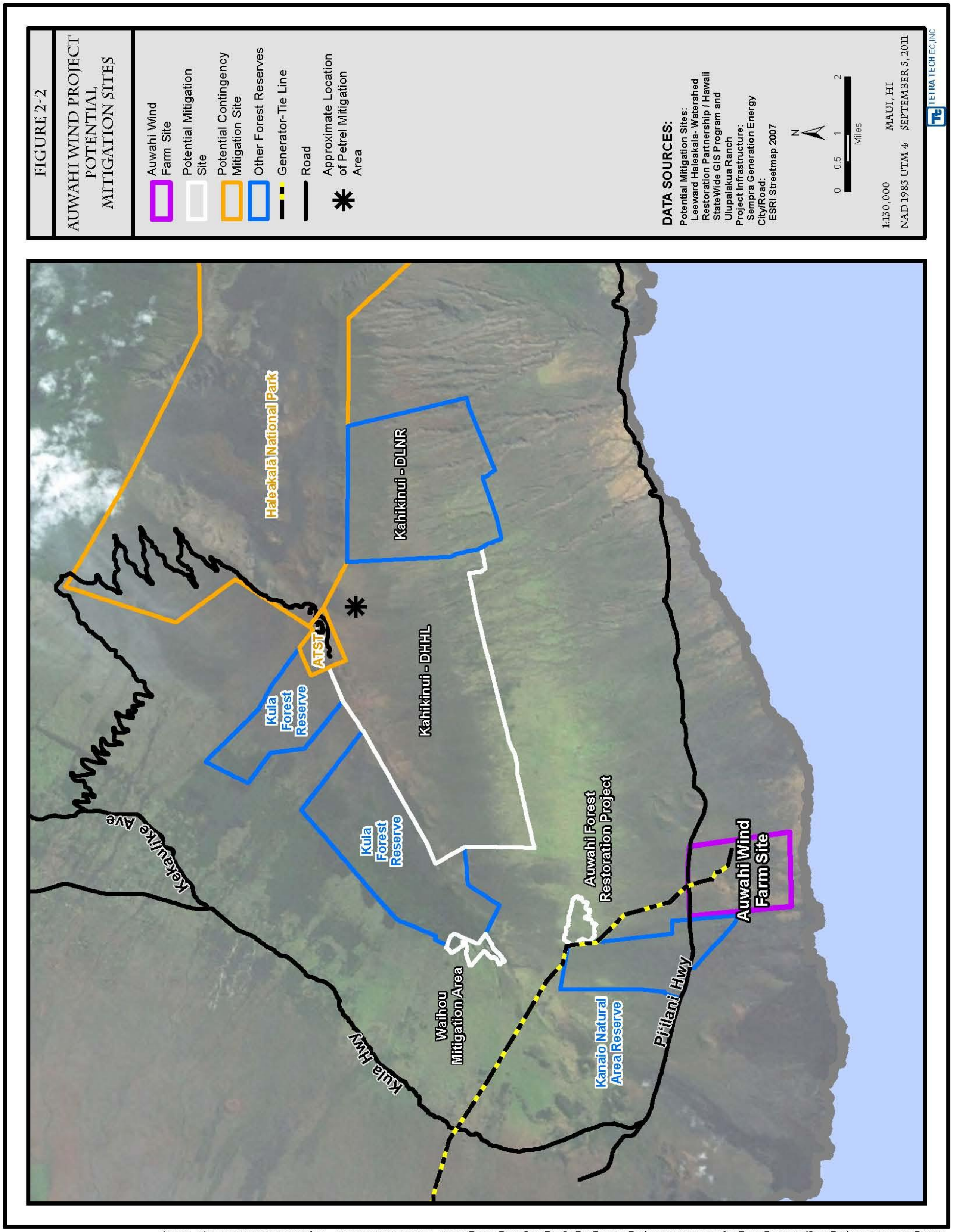


FIGURE 2-2
AUWAHI WIND PROJECT
POTENTIAL
MITIGATION SITES
Auwahi Wind Farm Site
Potential Mitigation Site
Potential Contingency Mitigation Site
Other Forest Reserves
Generator-Tie Line
Road
Approximate Location of Petrel Mitigation Area
DATA SOURCES:
Potential Mitigation Sites:
Leeward Haleakala- Watershed Restoration Partnership / Hawaii StateWide GIS Program and Ulupalakua Ranch
Project Infrastructure:
Sempra Generation Energy
City/Road:
ESRI Streetmap 2007
N
0 0.5 1 2
Miles
1:130,000
NAD 1983 UTM 4
MAUI, HI
SEPTEMBER 5, 2011
TETRA TECH EC, INC
Haleakalā National Park
Kahikinui - DLNR
Kahikinui - DHHL
ATST
Kula Forest Reserve
Kula Forest Reserve
Keokea/ike Ave
Kula Hwy
Waihou Mitigation Area
Auwahi Forest Restoration Project
Auwahi Wind Farm Site
Kanaio Natural Area Reserve
Pi'ilani Hwy
P:\GIS_PROJECTS\Sempra_Energy\Auwahi_Wind_Project\MXDs\EA\Sempra_Auwahi_EA_Fig2-2_Mitigation_85x11_090511 - Last Accessed 9/5/2011 - Map Scale correct at: ANSI A (11" x 8.5")

sites has or is the subject of proposed restoration work conducted by the Leeward Haleakala Watershed Restoration Partnership (LHWRP), DLNR, and/or Ulupalakua Ranch. Restoration work in each of these sites focuses on the preservation, management, and restoration of remnant native or degraded habitats and forests on the leeward slope of Haleakala with the goal of creating or enhancing habitat for rare or listed plant and wildlife species including the Covered Species. Native habitats on Maui, including the subalpine and alpine habitats in the upper elevations in the Kahikinui site, have been degraded by feral ungulates, invasive plant species, and other land management activities. Microsites within the dryland and mesic forests on Maui that historically fostered unassisted, natural establishment of seedlings and saplings (shaded understory sites) have been so extensively damaged such that some native species have not reproduced naturally in the last 50 to several hundred years (USGS 2006). The proposed mitigation measures are intended to complement ongoing management actions. The following sections describe each of the mitigation sites and the restoration work ongoing within each. Secondary mitigation sites for the Hawaiian petrel also shown in Figure 2-2 and described in more detail below.

Auwahi Forest Restoration Project

The Auwahi Forest Restoration Project was initiated in 1997 by a coalition of private and public agencies spearheaded by the USGS and Ulupalakua Ranch. The Auwahi Forest Restoration Project is located on Ulupalakua Ranch and is protected by an agricultural conservation easement. The goal of the project is to protect the remnants of the native dryland forest and reestablish natural forest processes (e.g., seed dispersal and germination) that will support a self-sustaining forest ecosystem. To this end, the Auwahi Forest Restoration Project consists of a three-pronged approach including 1) fencing tracts of high quality forest to exclude ungulates; 2) eliminating kikuyu grass and other invasive species using both herbicides and hand pulling; and 3) outplanting of native tree, shrub, vine, and grass species that were elements of the original forest community (USGS 2006). Success of this approach has been demonstrated by the increase in native tree and shrub growth, including several endangered plant species, where these efforts have been implemented within the Auwahi Forest Restoration Project (USGS 2006). The entire restoration project consists of approximately 188 acres (76 ha; Figure 2-2). Fencing was installed in 1997 and outplanting was completed at the initial 10-acre (4-ha) portion of the Auwahi Forest Restoration Project. This site served as the pilot project for subsequent restoration efforts (USGS 2006). Outplanting is nearly complete for an additional 23 acres (9 ha) of the Auwahi Forest Restoration Project. Native shrubs and trees have recovered and now dominate both of these areas, providing a contrast to the surrounding pasturelands. The Auwahi site includes ohia, a species of tree documented as a roost tree for Hawaiian hoary bats, as well as aiea, the native host plant for the Blackburn's sphinx moth (USGS 2006; Gorressen et al. 2008). Fencing of the remaining 155 acres (63 ha) of the Auwahi Forest Restoration Project has been completed and outplanting is ongoing.

Waihou Mitigation Area

The Waihou Mitigation Area, located on Ulupalakua Ranch, is an approximately 350–acre (142-ha) mitigation area includes four parcels, all owned by the ranch: Kaumaea Loko (61 acres [25 ha]), Puu Makua (195 acres [79 ha]), Duck Ponds (53 acres [21 ha]), and Cornwell Spring (41acres [17 ha]; Figure 2-3). The Waihou Mitigation Area contains degraded and remnant patches of rare, native forest ecosystems which are the focus of restoration, and provide suitable foraging, breeding, and roosting habitat for Hawaiian hoary bats. The Waihou Mitigation Area is a mosaic of vegetative communities dominated by pastureland (see photos of the Waihou Mitigation Area provided in the

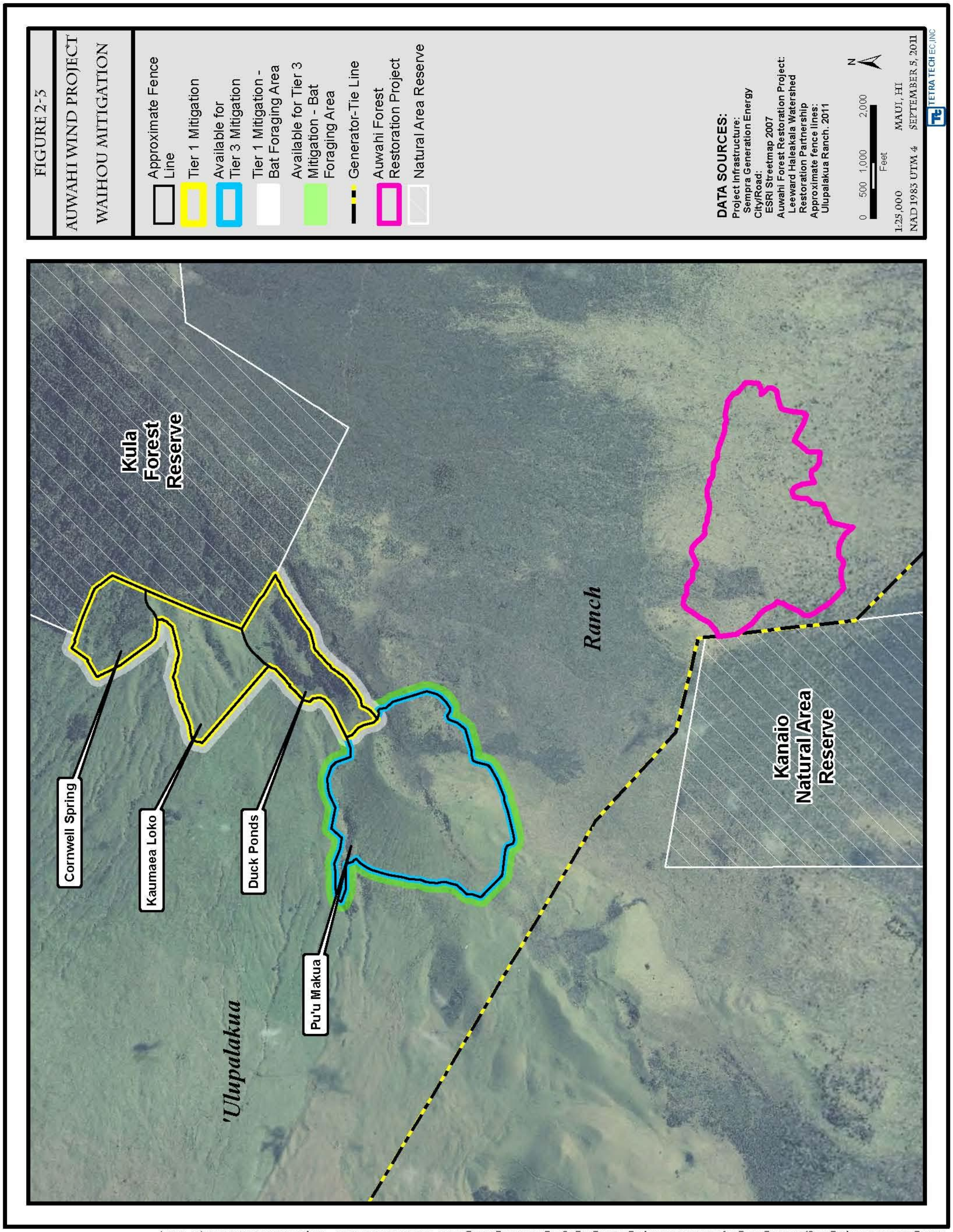


FIGURE 2-3
AUWAHI WIND PROJECT
WAIHOU MITIGATION
Approximate Fence Line
Tier 1 Mitigation
Available for Tier 3 Mitigation
Tier 1 Mitigation - Bat Foraging Area
Available for Tier 3 Mitigation - Bat Foraging Area
Generator-Tie Line
Auwahi Forest Restoration Project
Natural Area Reserve
DATA SOURCES:
Project Infrastructure:
Sempra Generation Energy
City/Road:
ESRI Streetmap 2007
Auwahi Forest Restoration Project:
Leeward Haleakala Watershed Restoration Partnership
Approximate fence lines:
Ulupalakua Ranch. 2011
0 500 1,000 2,000
Feet
1:25,000
MAUI, HI
NAD 1983 UTM 4
SEPTEMBER 5, 2011
TETRA TECH EC, INC
Kula Forest Reserve
Ranch
Kanaio Natural Area Reserve
'Ulupalakua
Cornwell Spring
Kaumaea Loko
Duck Ponds
Pu'u Makua
P:\GIS_PROJECTS\Sempra_Energy\Auwahi_Wind_Project\MXDs\EA\Sempra_Auwahi_EA_Fig2-3_WaihouMit_85x11_090511 - Last Accessed: 9/5/2011 - Map Scale correct at: ANSI A (11" x 8.5")

HCP). All parcels have had some level of plantings although on a small scale and are enclosed with cattle fencing. The Kaumaea Loko parcel is currently dominated by kikuyu and funding is currently available to add an ungulate-proof fence and to reforest portions of the area by outplanting. The Cornwell Spring parcel is partially forested with koa and Pacific ash with the remainder pastureland.

The Duck Ponds parcel is partially forested with Monterey pines and the remainder is pastureland. The Puu Makua parcel is dominated by pastureland. None of these parcels are currently protected by a conservation easement or have guaranteed funding for long-term management measures such as forest restoration, ungulate removal, and invasive species control management. The restoration and management activities outlined below are intended to restore these parcels to provide additional bat breeding, foraging, and traveling habitat and to provide a contiguous corridor with other state reserves protecting bat habitat and where bats are known to occur.

Kahikinui Forest Project

The objective of the Kahikinui Forest Project is to protect and restore remnant native habitats and forest along the southern slope of Haleakala. The LHWRP and DLNR propose to manage Kahikinui and restore the native forest by installing adequate fencing to protect the area from non-native ungulates, followed by the removal of ungulates and predators (cats and mongooses) from within the fenceline, elimination of invasive weeds, and finally reforestation with native plant species. The LHWRP is a coalition that was formed in June 2003 by 11 private and public landowners and supporting agencies. The LHWRP is partnering with the Department of Hawaiian Home Lands (DHHL) and DLNR to implement this overall program on all their lands, which encompass approximately 8,000 acres (3,237 ha), with initial focus placed on 5,200 acres (2,104 ha) of DHHL lands (Medeiros, pers. comm., 2010). Prior to the 1800s, the leeward flanks of Haleakala were covered in extensive koa forests. These koa forests, among the most robust and diverse in the archipelago, supported abundant native Hawaiian flora and fauna, some of it found nowhere else in the world. Through fog interception these forests, which were over 100 ft (30 m) tall, contributed to a greater volume of water than other areas in this region of limited rainfall. In the past 200 years, systematic deforestation due to overgrazing by feral ungulates has reduced forest cover to less than 5 to 10 percent of former extents, none of it intact. In response to this decline, the LHWRP and DLNR's goal is to restore native watershed forests on Haleakala from Makawao through Ulupalakua to Kaupo (Medeiros, pers. comm., 2010).

Restoration of the watershed and forests will benefit a number of native Hawaiian species including the Hawaiian hoary bat, Hawaiian petrel, and other native bird species. Furthermore, active petrel burrows sufficient to manage for this Project have been identified the upper portion of Kahikinui where the landscape is mostly unvegetated. Photographs of the Kahikinui petrel mitigation area are provided in the HCP.

The LHWRP will construct a 7-ft (2-m) high ungulate-proof fence with no gaps at the ground, the standard for exclusion of feral ungulates (Reeser and Harry 2005; Mederios 2011). The fence is designed to encompass the perimeter of the Kahikinui Forest Project so that it will connect the DHHL and DLNR properties resulting in the protection of the entire 8,000-acre (3,237-ha) project. The current LHWRP proposal includes three legs of fencing consisting of 7.8 miles (13.1 km) of new fence and 1.7 miles (2.8 km) of upgrades to existing fence.

Once the fence is in place, introduced ungulates, including feral goats, pigs, axis deer, and cattle, will be removed from the Kahikinui Forest Project. These introduced ungulates browse on native vegetation and groundcover and may affect the Covered Species by trampling and collapsing petrel burrows, causing nest abandonment within colonies. The soil disturbance caused by ungulates also facilitates the introduction and spread of invasive plants, which further reduces habitat suitability for the Covered Species (Reeser and Harry 2005). Ungulates also create trails in the colony that increase access for predators to active burrows. Once ungulates have been removed from the fenceline, additional mitigation measures such as predator control and vegetation restoration can be undertaken.

Mitigation under the Proposed Action would be located at the upper elevations of the Kahikinui Forest Project. The proposed petrel mitigation site is located within the State of Hawaii Conservation District, on land designated as Resource Subzone. The area is located southwest of Haleakala National Park and east of the Advanced Technology Solar Telescope (ATST) observatory site.

Mitigation for Potential Impacts to Hawaiian Hoary Bat

The recovery plan for the Hawaiian hoary bat (USFWS 1998) states that bat populations can be threatened by habitat loss, pesticides, predation, and roost disturbance. The recovery criteria identified in the Hawaiian hoary bat recovery plan (USFWS 1998) list protecting and managing key roosting and foraging areas and research essential to the conservation of the subspecies as the first two actions needed for the species recovery. Bat mitigation will be implemented per tier: Tier 1—habitat conservation and enhancement; Tier 2—research study; and Tier 3—adaptive management to incorporate either additional habitat preservation or bat management reflecting the results of the research. Mitigation for Tiers 1 and 2 will be initiated within 30 days of the issuance of the ITP. Tier 3 mitigation will be initiated if the Tier 3 take level is triggered.

Tier 1 Mitigation

The Auwahi mitigation for bats is based the results of Home Range Tools for ArcGIS®, Version 1.1 (compiled September 19, 2007) calculations based on Hawaiian hoary bat tracking data collected by USGS-BRD Wildlife Ecologist, Dr. Frank Bonaccorso (Greenlee, pers. comm. 2011). This dataset from a two-week tracking study indicated that the mean core area of rainforest habitat on the island of Hawaii used by 14 male bats was 84.3 acres (34.1 ha) and the average size of the core area utilized by the 11 females in the dataset was 41.2 acres (16.7 ha). Foraging habitat may be a limiting factor to the recovery of the Hawaiian hoary bat (USFWS 1998). Thus, upland forest habitat restoration be completed as mitigation for bat take at the rate of 84.3 ac per pair of bats (one male and one female). Current research indicates male bat core areas do not appear to overlap but female core areas may overlap with male core areas (Bonaccorso, pers. comm., 2011). A core area was defined as the area that incorporates 50 percent of tracked movements; therefore, the core area is an appropriate minimum habitat requirement for bats. Hence, in an 84.3-ac forest, one pair of bats may be found. Furthermore, as Hawaiian hoary bats are conservatively estimated to live 10 years, for a 20-year project like Auwahi Wind project, up to two pairs of bats may use the 84.3-acre area. Hence, Auwahi Wind will compensate for the take of a pair of bats by restoring 40 ac. (80 ac. for a pair of bats/ 2 lifespans = 40 ac.). Because the bat habitat restoration area will be conserved, in perpetuity, by a permanent conservation easement, the project will contribute to the recovery of the species by permanently increasing Maui's Hawaiian hoary bat carrying capacity.

The Tier 1 requested take level for bats is 5 adults and 2 juveniles. To mitigate for the loss of these bats, it is necessary to determine the total number of adult bats represented by the 2 juveniles. An estimated 30 percent of juveniles survive to adulthood (based on little brown bat survival; Humphrey 1982), the 2 juveniles represent 0.6 adult bat. Thus the Tier 1 requested take level equates to 6 adult bats. Assuming a 50:50 adult sex ratio, the potential take of 6 adults would result in the take of 3 adult male and 3 adult female bats. Auwahi Wind proposes restoration of 252.9 acres (102.3 ha) as mitigation for the take of these 3 adult male and 3 adult female bats. Assuming that one core area supports one bat at a given time, and assuming that the lifespan of a Hawaiian hoary bat is approximately 6 years (similar to mainland subspecies), then it could be conservatively assumed that one core area could be used by, or benefit, up to 4 male bats over the 25-year permit term. Additionally, benefits of restoration would presumably extend beyond the 25-year term of the ITP/ITL. However, Auwahi Wind recognizes that the benefits of the restoration activities may take some time, so has conservatively assumed that 2 male bats will benefit from the enhancement or preservation of each core area of habitat over the life of the Project. Based on this assumption, 126.5 acres will be restored to Hawaiian hoary bat habitat to offset Tier 1 take.

The proposed mitigation area identified to compensate for potential take of bats by the Auwahi Wind project occurs on the northern section of the Ulupalakua Ranch referred to as the Waihou Mitigation Area (Figure 2-3). The Waihou Mitigation Area contains degraded and remnant patches of rare, native forest ecosystems that are the focus of restoration and management, and provide suitable foraging, breeding, and roosting habitat for Hawaiian hoary bats (Erdman, pers. comm., 2011; Medeiros, pers. comm., 2011). This mitigation area will provide additional benefits for Hawaiian hoary bat mitigation because it is adjacent to the Kula Forest Reserve, which currently has extensive native vegetation and bat habitat; creates a travel corridor between Kula Forest Reserve, Auwahi Forest Restoration Project, and the Kanaio Forest Reserve, which can offset habitat fragmentation/genetic concerns; and has existing water sources in the form of ponds and springs that provide food for breeding and non-breeding bats.

Mitigation will be conducted under an approved management plan at the Waihou Mitigation Area (see below) and will entail ungulate fencing (either by installing ungulate fencing or upgrading existing cattle fence), removing ungulates, removing or managing invasive vegetation, and conducting forest restoration activities (either outplantings or natural regeneration, where appropriate). These activities will protect native vegetation from disturbance and destruction; facilitate the growth of native plants by eliminating alien species that outcompete them and/or prevent their natural regeneration; and work to reestablish a self-sustaining native forest. Mitigation activities will enhance foraging, breeding, and roosting habitat for Hawaiian hoary bats by facilitating the recovery of native vegetation and reestablishment of the forest canopy while allowing for open areas for foraging within the mitigation area, ultimately contributing to the restoration of Maui's native forest ecosystem. Ulupalakua Ranch is a partner and has consented to creating and implementing the management activities in this bat mitigation area with Auwahi Wind. Auwahi Wind will ensure that the management activities described in this section are fully implemented.

In addition, this mitigation area will be preserved in perpetuity by recording a conservation easement running with the land. Such conservation easement will preclude future development of the mitigation land, and preclude any land use activities inconsistent with bat conservation (e.g., timber harvesting, forest clearing, road construction). Ulupalakua Ranch has agreed to grant this conservation easement, and Auwahi Wind will ensure that Ulupalakua Ranch grants such conservation easement to a state or local government agency or a private non-profit organization qualified to hold conservation easements, and records such easement.

If the Kahikinui pooled partnership mitigation option becomes a viable bat mitigation option for the Project, a conservation easement would not be required over the Waihou Areas. In addition, the timeframe may be shifted if this option was implemented while the funding mechanisms are instituted.

The following provides a summary of the management activities to occur within the mitigation area. These management activities will be incorporated in more detail into a management plan for the mitigation area that will describe the goals of the management plan, the current conditions, the management activities and schedule to be executed, adaptive management options, and measures of success criteria. The management plan will be developed prior to construction of the vertical portions of the WTGs. Success criteria will be refined based on information about bat biology and vegetation restoration and may be provided in the context of species composition or reestablishment of the forest. Auwahi Wind may need to revise elements of the management plan for the mitigation area over time based on the best available information. Changes to the management activities presented below, independent of who initiates the changes, will be made with approval of the USFWS and DOFAW.

Tier 1 mitigation will occur within the 155-acre (62-ha) area comprised of the Cornwell Spring, Kaumaea Loko, and Duck Pond parcels of the Waihou Mitigation Area and the foraging area immediately surrounding the parcels (Figure 2-3). The Cornwell Spring area is 41 acres (17 ha), the Kaumaea Loko area is 61 acres (25 ha), and the Duck Pond area is 53 acres (21 ha). Because Ulupalakua Ranch will be receiving some matching federal funds toward the fencing and planting of the Kaumaea Loko area, Auwahi Wind will count only 50 percent of the acreage of Kaumaea Loko towards its bat mitigation. Therefore, the total acreage counted for bat mitigation is 125 acres (41 + 31 [i.e., 50 percent of 61] + 53 acres), although 155 acres (62 ha) will be put into conservation easement. Auwahi Wind will get full credit for the Kaumaea Loko parcel if Ulupalakua Ranch does not accept federal funding and only 125 acres will be managed at Waihou.

Additionally, Auwahi Wind assumes that the area 148 feet (45 m) outside of the conservation easements, adjacent to the mitigation parcels, will also be used as foraging areas by the hoary bats if they are maintained in pasture, as hoary bats often forage in open areas (Greenlee pers. comm. 2011). Maintenance of grazed pasture will reduce fire threat to the forest restoration area for the life of the project. Thus, this additional foraging area will add 44 acres to the 125 acres of bat habitat required for Tier 1 mitigation.

To protect these parcels from ungulates, the existing cattle fence will be retrofitted to be ungulate-proof fencing. Retrofitting will begin within the first year of permit issuance and be completed within 2 years of permit issuance. Retrofitting the fence was selected because it is cost effective and minimizes disturbance to other resources. The Kaumaea Loko parcel will have new ungulate fencing and will not need to be retrofitted. Combined over all the parcels, this fence will result in the complete enclosure of the approximately 155-acre (62 ha) area. The fence will be inspected annually to identify any issues and to ensure its integrity throughout the life of the permit.

Retrofitting activities would occur along approximately 5,315 linear ft [1,620 linear m]) around the Cornwell Springs parcel and approximately 7,990 linear ft [2,435 m]) around the Duck Ponds parcel, and would occur within an approximately 5-ft (1.5 m) wide area along the boundary of the existing fences. Vegetation removal is anticipated to be minor, but would occur if vegetation inhibits retrofitting of the fence. This would result in a total area of approximately 0.9 acres (0.4 hectare) and 0.6 acres (0.3 hectare) where ground-disturbing activities could occur associated with the Duck Ponds and Cornwell Spring fences, respectively. As noted above, installing new fence around the Kaumaea Loko parcel will have been completed prior to the issuance of the ITP/ITL and therefore no additional disturbance would be associated with this fence. Maintenance of the grazed pasture outside the fencelines, which are currently grazed, would not result in additional vegetation disturbance. Figure 2-4 depicts an existing cattle fence at the Waihou Mitigation Area.

Figure 2-4. Existing cattle fence at the Waihou Mitigation Area, Ulupalakua Ranch.

Retrofitting would involve topping the existing 4-ft (1.2-m) tall hog wire fence with ungulate-proof hog wire mesh, resulting in an 8-ft (2.4-m) high fence. The existing "T" posts would be replaced where needed with galvanized steel "T" posts of up to 10 ft (3 m) in length. Fence posts would be driven into the ground to a depth of approximately 1 to 2 ft (0.3 to 0.6 m), resulting in a fence height above ground of approximately 8 ft (2.4 m). At corners or sharp bends in the alignment, gates, abrupt slope changes larger diameter (i.e., 4 inches [10.2 cm]) posts made of wood or metal pipe may be required for reinforcement. To prevent the ingress of ungulates, deer gates 8 ft (2.4 m) high would be required in places where existing ranch roads cross the fencelines. New fence material would consist of 8-ft (2.4-m) tall ungulate-proof hog wire with no barbed wire strands, which typically has a mesh size of less than 6 inches (15.2 cm). The mesh would be attached to the fence posts using steel clips, staples, or similar fixtures. If necessary, in places where the ground surface is irregular, resulting in gaps at the bottom of the fence, an additional mesh apron may be attached to the fence, which would drape over the ground to prevent animals from passing under the fence. Figure 2-5 shows the proposed ungulate-proof fence.

All clearing and other construction activity associated with fence retrofitting would occur along an existing fenceline; therefore, impacts to sensitive plants or archaeological and cultural features would be negligible given that the area has been previously disturbed. It is anticipated that there may be some sections of fence that require full replacement; however, new fencing would be placed in the same location as the existing fence. Fence materials (posts and wire) would be transported to the Waihou Mitigation Area by flatbed truck to the staging area using existing Ulupalakua Ranch roads. It is assumed that no widening or improvements of the roads would be required before the fence is installed.

After the ungulate-proof fence retrofitting is completed, ungulates will be removed from within the fenced area within 2 years of fence completion. Methods may include hunting or trapping. Following ungulate removal, restoration efforts will begin. A site visit was conducted in October

Figure 2-5. Depiction of proposed ungulate-proof fence.

2011 to evaluate the existing conditions and restoration potential of each of the Waihou Mitigation Area parcels. Based on observations made during this site visit, it is anticipated that restoration will include a combination of invasive species control, planting of native trees and shrubs, maintenance of existing forest stands, and maintenance of open foraging areas surrounding ponds. Auwahi Wind will work with Ulupalakua Ranch to manage the parcels to include both forested areas (through outplanting and natural regeneration) and open areas at levels and locations which will be mapped and described in detail in the management plan.

There are three general types of vegetation where mitigation would occur on Waihou: pasture, areas with some native forest, and areas with Monterey pine. Open pasture areas, which are dominant within Waihou, will be planted with a combination of trees and shrubs. Species chosen for plantings will depend on the location within the parcel but will likely include predominately koa, ohia lehua (*Metrosideros polymorpha*), aalii (*Dodonaea viscose*), and kolea lau nui, along with additional native trees and understory plantings (Appendix A includes a list of potential plants to be used). Koa is fast growing, and therefore will reach heights suitable for bat roosting in a few years, while the slower growing species such as ohia lehua mature. To increase stand diversity, tree plantings (spaced approximately 8 to 10 feet on center) will be interspersed with understory shrub plantings. Invasive species removal and control will also be conducted in these areas. Over time, it is anticipated that a mature forest canopy dominated by koa and ohia will develop in reforested areas providing suitable roosting and breeding habitat for bats. Native forest and non-native Monterey pine forest provide suitable roosting and breeding habitat for bats in some portions of the Waihou Mitigation Area; therefore, the management focus in these stands will be to maintain mature trees and conduct invasive species removal where necessary. Native forest stands, particularly those with a more open overstory include patchy growth of invasive species such as ash, black wattle, and blackberry which will be removed and controlled. The Monterey pine stands typically have dense overstories which shade the understory, limiting invasive understory plant growth. However, pines continue to encroach into the adjacent open pastures; therefore, management will focus on removal of pine saplings on the peripheries of these stands to prevent further encroachment. Restoration efforts will have the added benefit of creating and enhancing habitat for native forest birds including the amakihi, Maui creeper, elepaio, and pueo which are known to occur there. The Duck Ponds parcel also includes several small ponds which will be managed. The extent of forest canopy closure and related restoration objectives will be developed by Auwahi Wind through discussions with qualified restoration specialists experienced with native Hawaiian forest ecosystems and bat experts in Hawaii with knowledge of the best available science. The Applicant will be responsible for ensuring the successful implementation of approved mitigation strategies.

The Waihou Mitigation Area would be owned by Ulupalakua Ranch and entered into a permanent conservation easement; however, Auwahi Wind would fund the retrofitting/construction and maintenance of the fences, ensure that the mitigation area is kept free of ungulates, and monitor the success of plantings within the parcels. Auwahi Wind's responsibility at the Waihou Mitigation Area would last for the duration of the 25-year term of the ITP. The proposed fencing is consistent with the goals and objectives of the Ulupalakua Ranch and would contribute to ongoing efforts on the ranch to restore the watershed by protecting and/or restoring native forest.

Tier 2 Mitigation

The Tier 2 requested take level for bats is 10 adults and 4 juveniles. To mitigate for the Tier 2 requested take level, it is necessary to determine the total number of adult bats represented by the 4 juveniles. Assuming that 30 percent of juveniles survive to adulthood (based on little brown bat survival; Humphrey 1982), the 4 juveniles represent 1 adult bat. Thus the Tier 2 requested take level equates to a total of 11 adult bats and will require mitigation for an additional 5 adult bats over the Tier 1 mitigation. For Tier 2 mitigation, Auwahi Wind will fund research projects that contribute to the overall knowledge of the Hawaiian hoary bat on Maui. Auwahi Wind will initiate this research within 2 years of the issuance of the ITP regardless of take levels. This research project will be used to monitor the success of the Tier 1 mitigation.

Auwahi Wind will provide $150,000 to $300,000 for a Hawaiian hoary bat research project to provide additional data that contribute to the knowledge of the Hawaiian hoary bat on Maui. Auwahi Wind will work with a qualified bat biologist, approved by DOFAW and USFWS, to design a radio telemetry study within the mitigation area or similar study to help evaluate bat population trends on Maui, as required in the Hawaiian hoary bat recovery plan. If the radio-telemetry option is chosen, it will be designed to 1) estimate of male and female core areas and home ranges, 2) identify habitat associated with foraging and roosting, and 3) collect data for genetic evaluation of effective population size. Data will be collected over an approximately 4- to 8-week period after the young of the year have become independent. Data will be collected in 3 separate years. The initial year of data collection will be within 2 years of commercial operation of the wind farm and during the initial restoration efforts of the mitigation parcel. The second and third years of data collection will be at years 8 and 16 of commercial operation of the project. This will ensure that data have been collected when the mitigation site is in different stages of vegetative development.

Auwahi Wind will provide a formal research plan and study design to USFWS and DOFAW for review. The research plan will be finalized before the initiation of the study, which will occur within 2 years after the issuance of the ITP. Research reports will be completed after each year's data collection and for the later years will include a comparison to the previous year's results. Reports will be provided to USFWS and DOFAW as part of Auwahi Wind's annual reports. If logistical or other constraints prevent the execution of the study described above, Auwahi Wind will provide a total of

$150,000 to $300,000 towards a different applied search study, as agreed upon by USFWS and DOFAW.

Tier 3 Mitigation

Given the lack of bat roosting habitat on the project site and the monitoring data from another Maui wind project, Auwahi Wind expects that Tier 3 is very unlikely to be triggered. However, due to the uncertainty associated with estimating bat fatalities, Auwahi Wind has included this third tier of take and mitigation out of an abundance of caution.

Mitigation levels were established based upon a 24-hour operation of the wind farm for the life of the project, such operation will not take place. Instead, the WTGs are expected to be curtailed (turned off) during times when bats are expected to be active. As a result, Auwahi Wind expects that likelihood of triggering Tier 3 is low.

The Tier 3 requested take level is 19 adults and 8 young. To mitigate for the loss of these bats, Auwahi Wind estimated the total number of adult represented by the 8 juveniles. Assuming that 30 percent of juveniles survive to adulthood (based on little brown bat survival; Humphrey 1982) the 8 juveniles represent 2 adult bats. Thus, the Tier 3 requested take level equates to a total of 21 adult bats, requiring mitigation for an additional 10 adult bats over the Tier 2 level. Should the Tier 3 mitigation be required, Auwahi Wind will use the results of the research conducted to date in Tier 2 and data from other applicable studies to identify appropriate mitigation measures to be implemented potentially including the restoration of forest habitat using native species.

In the event that Tier 3 take is reached and Tier 3 mitigation triggered, Auwahi Wind will focus mitigation efforts on one or more alternate mitigation sites and/or additional research in consultation with and subject to the approval of the USFWS and DOFAW. Selection of site and mitigation focus will depend on agency recommendation and timing, such that mitigation activities will integrate with and enhance ongoing management actions at the selected site. The Waihou Mitigation Area, the Kahikinui Forest Project, and the Auwahi Forest Restoration Project will serve as potential Tier 3 mitigation sites for bat mitigation. Within the Waihou Mitigation Area (first priority), Auwahi Wind has the option to expand the fenced portion to include all or part of the 195–acre (79-ha) Puu Makua area to be placed in a permanent conservation easement. This parcel would include up to 41 acres (16.6 ha) of bat foraging area. Methods for fence retrofitting would follow those described above for Tier 1 mitigation. Retrofitting the existing cattle fence around all or part of the Puu Makua parcel would occur along up to approximately 13,150 linear ft [4,008 linear m]), and would result in an additional 1.5 acres (0.6 hectares) of ground disturbance near the fenceline. Furthermore, should DOFAW establish a pooled-partnership for bat mitigation at the Kahikinui Forest Project or another appropriate bat mitigation site during the term of this HCP, Auwahi Wind will consider this as a possible mitigation option in lieu of some or all of the mitigation described above, subject to approval by DOFAW and USFWS.

Auwahi Wind would ensure adequate funding is available when Tier 3 mitigation is triggered to implement appropriate Tier 3 bat management measures such as habitat enhancement, restoration, monitoring, or additional research as determined to be appropriate in consultation with USFWS and DOFAW.

Mitigation for Potential Impacts to Hawaiian Petrel

The primary limiting factors for the Hawaiian petrel population on Maui include predation by introduced animals and habitat degradation and disturbance at breeding colonies (Carlile et al. 2003). Therefore, in keeping with the Hawaiian petrel recovery plan (USFWS 1983) and to mitigate its unavoidable impacts, Auwahi Wind will conduct habitat management and predator control at a confirmed Hawaiian petrel breeding colony, in order to improve reproductive success. As discussed below, Auwahi Wind has determined the number of active petrel burrows it must manage to achieve the required mitigation and net benefit requirements. Initial surveys in April and June/July 2011 confirmed that Hawaiian petrels are breeding within the Kahikinui Forest Project and that this parel contains enough active burrows to mitigate for project-related take (see population modeling discussion below). Baseline surveys will be conducted during the spring/summer of 2012 to delineate the boundaries of the breeding colony area to be managed. This will be followed by implementing management activities to remove predators and improve breeding success.

The activities proposed here would benefit the petrels in multiple ways. First, the surveys provide information about the number and location of petrel burrows within the previously unsurveyed Kahikinui Forest Project, thereby providing important information about the distribution of petrels on Maui. Second, predator management will increase survival and reproduction of petrels, thus changing the population growth rate and the probability that the species will move toward recovery. Third, anecdotal evidence from Haleakala National Park indicates that when predator and ungulate control is implemented, the population appears to increase. The following sections describe the surveys that have been conducted to date, modeling of predator control benefits, and next steps.

Spring Reconnaissance Surveys

Auwahi Wind conducted an initial 2-day reconnaissance survey of the Kahikinui Forest Project in April 2011. The purposes of this survey, which was knowingly conducted prior to the start of petrel nesting activity, were to determine 1) whether petrel nesting is occurring in the Kahikinui Forest Project (something that has been suspected but never previously verified); 2) identify general areas within the Kahikinui Forest Project where petrel burrows are located; and 3) identify specific burrows with active or old signs of petrel use. The reconnaissance survey confirmed that petrels are nesting in the Kahikinui Forest Project; surveyors identified 20 burrows with active or old sign of petrel use (e.g., droppings, egg shell fragments, feathers, or tracks) and an additional 10 burrows without obvious petrel sign (Figure 2-6).

Summer 2011 Focused Surveys

Auwahi Wind conducted focused petrel surveys in the Kahikinui Forest Project during the summer period when petrels had returned to the breeding colony, enabling Auwahi Wind to verify the location of currently active petrel burrows. Surveys were conducted from June 27 to July 2, 2011, by systematically surveying potential petrel breeding areas by spacing surveyors 15 to 50 feet (5 to 15 m) apart, depending on the terrain. All the petrel burrows found in April were relocated and checked for breeding status during these surveys. A total of 44 burrows with petrel sign were located during the surveys, 20 burrows during the April surveys and 24 additional burrows were found during the June/July surveys (Figure 2-6). Thirty-three of the burrows had petrel sign from 2011 (Figure 2-6). Sign of predators and depredation seen during the surveys including two dead adult petrels outside of a burrow, feral cat scat containing eggshells, and rat remains and feces. Auwahi Wind used this information to identify an area within the Kahikinui Forest Project that contains a sufficient number of currently active burrows that can effectively be managed to improve breeding success.

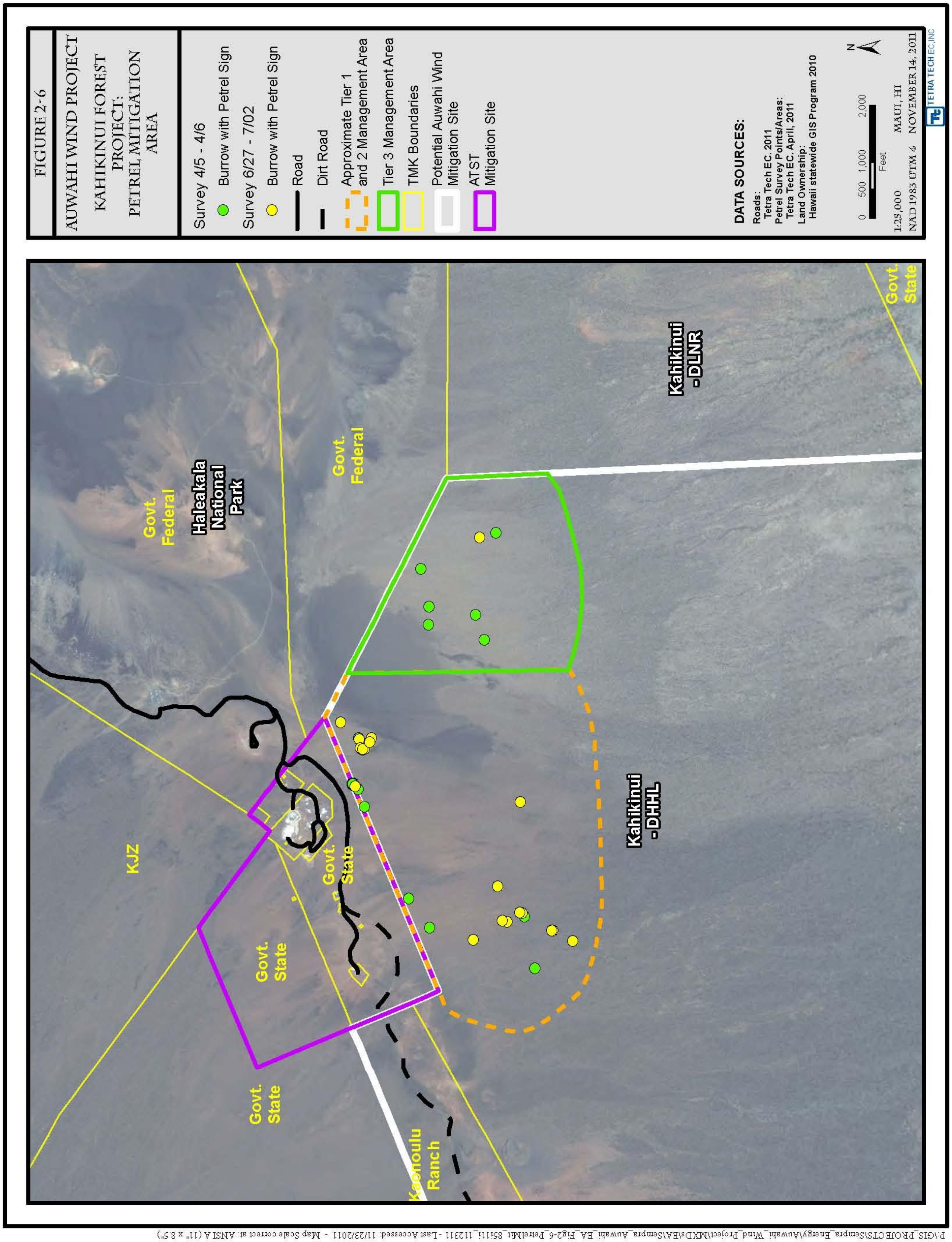


FIGURE 2-6
AUWAHI WIND PROJECT
KAHIKINUI FOREST PROJECT: PETREL MITIGATION AREA
Survey 4/5 - 4/6
Burrow with Petrel Sign
Survey 6/27 - 7/02
Burrow with Petrel Sign
Road
Dirt Road
Approximate Tier 1 and 2 Management Area
Tier 3 Management Area
TMK Boundaries
Potential Auwahi Wind Mitigation Site
ATST Mitigation Site
DATA SOURCES:
Roads: Tetra Tech EC, 2011
Petrel Survey Points/Areas: Tetra Tech EC, April, 2011
Land Ownership: Hawaii statewide GIS Program 2010
0 500 1,000 2,000
Feet
1:25,000
NAD 1983 UTM 4
MAUI, HI
NOVEMBER 14, 2011
TETRA TECH EC, INC
Govt. Federal
Haleakala National Park
Govt. Federal
Kahikinui -DLNR
Govt. State
KJZ
Govt. State
Govt. State
Kahikinui -DHHL
Govt. State
Kaonoulu Ranch

Predicting the Effects of Predator Control

Auwahi Wind evaluated population and net benefit projections under scenarios with and without predator control. This was done by (1) taking into account the current estimated size of the breeding population, (2) estimating the size of the breeding population over time without management, (3) calculating the size of the adult population (breeders and nonbreeders) at a colony after population management, and then (4) evaluating the expected success of the predator control program by taking the difference in the number of adults in the unmanaged population versus a population managed under three predator control scenarios (i.e., resulting in moderate, mild, and minimal predation, respectively; see the project HCP for details and assumptions for the population model.)

Based on the preliminary assessments of burrow availability and activity at Kahikinui, Tetra Tech performed an iterative series of analyses for a population of 25 breeding pairs (33 active burrows) and 33 breeding pairs (44 active burrows). This exercise demonstrated that if the proposed predator control strategy achieves the Mild Predation scenario, the realized benefit after 20 years is projected to range between 26 and 34 adult petrels, thereby mitigating take at both Tier 1 and Tier 2 levels. If the proposed predator control strategy achieves the Minimal Predation scenario, the realized benefit after 20 years is projected to range between 61 and 81 adult petrels, thereby mitigating take at all three predicted levels (see Table 6-5a of the project HCP). Tetra Tech has evaluated mitigation based on a 20 year period because this is likely to be the period when the wind farm is in operation. Predator control will be implemented during the 20-year petrel mitigation period, DOFAW and USFWS will approve any changes such as if additional burrows are managed.

Auwahi Wind used demographic values provided by the USFWS (Greenlee pers. comm. 2011; based on Simons 1984) to represent vital rates under baseline conditions and when petrels are protected by varying levels of predator control. The primary assumption underling these demographic scenarios is that predator trapping alone does not result in a self-sustaining population; however, data from the National Park Service (NPS) (Haleaka National Park, unpublished data) suggests that a predator control campaign consisting of predator trapping and ungulate fencing (without predator exclusion fencing) can contribute to a self-sustaining Hawaiian petrel population. Hence, the demographic scenario resulting from predator trapping and ungulate fencing likely lies between the Mild and Minimal Predation scenarios (Table 2.2.3). If predator-proof fencing becomes a viable option for Kahikinui at some point in the future, benefits to petrels would likely be greater.

Population modeling based on the life history attributes in Table 2.2.3, indicates predator trapping to conserve 33-44 active burrows at Kahikinui (occupied by an estimated 66-88 actively breeding Hawaiian petrels, which represent approximately 75 percent of the total adult population in any given year) for 20 years would ensure the site is occupied by approximately 43-58 adult Hawaiian petrels in year 20 (breeding and non-breeding adults), instead of the 18-24 birds we would expect to be left with in the absence of predator management (offsetting the loss of 25-34 adult Hawaiian petrels and most likely mitigating projected Tier 1 and 2 take). If predator control of additional burrows is needed to achieve the necessary mitigation, Auwahi Wind will assume management of additional burrows at Kahikinui and/or the ATST mitigation parcel after their mitigation responsibilities have been met (ATST 2010). Management of the ATST mitigation site for years 11 through 20 would result in the maintenance of an ATST colony of approximately 98 Hawaiian petrels versus the approximately 64 birds that would have been at the site in the absence of predator management (offsetting the loss of 34 Hawaiian petrels). The two mitigation projects, together, would offset the take of 59-68 Hawaiian petrels. Auwahi Wind's Tier 3 take request is 64 adult

Table 2.2-3. Hawaiian petrel life history attributes used to model benefits of predator trapping.

	Life History Parameters (Annual Rates)				
Predation Severity*	**Adult Survival**	**Juvenile survival (Simons 1984 p. 1070)**	**Fledglings per Female**	**Fecundity (Female Fledglings per Egg Laid)**	**Model Results (Lambda)**
Minimal Predation (Cat/Mongoose Fencing and Rat Control)	0.93 (Simons 1984 p. 1070)	0.8034	0.72 (Simons 1984 p. 1068)	0.360	1.009
Mild Predation (Cat/Mongoose/ Trapping Only)	0.90 (Simons 1984 p. 1070)	0.8034	0.60 (Simons 1984 p. 1070)	0.300	0.978
Moderate Predation (No Management)	0.85 (Simons 1984 p. 1070)	0.8034	0.55 (Simons 1985 p. 237)	0.245	0.933

* The attribution of predator control techniques to Simons' predation severity classes represents the best professional judgment of the USFWS.

birds. Should Tier 3 take levels be documented, the addition of predator control activities at the ATST site could provide the required take mitigation, especially in light of the NPS observations that Auwahi Wind's mitigation strategy will create a more favorable demographic situation than is modeled here (i.e., lambda greater than 0.978). If management of the ATST site is not adequate to offset all Tier 3 take, population modeling indicates that an additional two years of management at Kahikinui or ATST would be adequate to reach the mitigation benefit.

Breeding Colony Habitat Management and Predator Control

Predator control has a positive impact on the survival of adult and young petrels and can be accomplished through trapping or installation of predator-proof fencing. Even an individual predator can be extremely destructive to a population of colony-nesting seabirds given the long lifespan, low annual productivity, and other reproductive characteristics of these species which make the replacement of depredated adults a slow process (Simons 1984, 1985). Predation accounted for approximately 41 percent of all bird and egg fatalities documented between 1961 and 1996 in Haleakala National Park (Hodges and Nagata 2001). Similarly, annual monitoring of nests at Haleakala National Park has shown that predation by cats and mongooses causes more than 60 percent of all egg and chick mortality in some years (Simons 1998 as cited in Carlile et al. 2003). Rats also prey upon Hawaiian petrels and their eggs. Predator removal has been shown to both improve petrel nesting activity and nesting success, as well as adult survival (Hodges and Nagata 2001). Current data from Haleakala National Park suggest that a predator trapping regime (in the absence of predator exclusion fencing) can contribute to a self-sustaining petrel population (Haleakala National Park, unpublished data).

Initially, options considered for predator control at Kahikinui included the installation of a predator-proof fence and/or predator trapping. Based on a site visit conducted in October 2011 with recognized predator-fence and vertebrate pest control expert Steve Sawyer of Ecoworks, it was determined that construction of a predator-proof fence is not a viable option for Kahikinui due to the substrates present and the extreme weather conditions at the site (Sawyer, pers. comm. 2011). The substrates, which range from basalt lava to light, highly mobile ash and small rocks, would not provide a solid, secure foundation to hold the structural integrity of the fence. Installation of the fence may require blasting or more extensive excavation with heavy machinery. Additionally, higher level fence maintenance would be required to ensure fence integrity because of the potential for damage due to the accumulation of light materials on the fenceline and weather events. Thus, mitigation at Kahikinui will be based on predator trapping. If over the 20 year management period, advances in predator fence technology result in the availability of a fence suitable for Kahikinui, installation of such a fence may be considered, in consultation with, and approval by, USFWS and DOFAW for Tier 3 mitigation. If the predator proof fencing option is implemented in the future, the plan for implementation must consider geotechnical and topographical challenges, weather related impacts to fencing and access to the Kahikinui mitigation site as well as potential impacts to cultural, archaeological, biological, and visual resources. Archaeological and biological surveys would be conducted along the fence alignment to enable avoidance of sensitive features, and all major construction activities would be conducted while birds are off-island to minimize impacts. For the purposes of this assessment, however, Auwahi Wind has assumed general dimensions of a fence alignment at Kahikinui based on similar fencing proposed for the petrel colony at Hawaii Volcanoes National Park(see below for additional information).

A detailed predator trapping and monitoring regime will be outlined in a separate petrel management plan which Auwahi Wind is currently developing prior to the construction of the vertical portions of the WTGs. The plan will be based on the known spatial distribution of the petrel burrows within the management area. The management plan will describe the methods to be used, the timing of mitigation efforts (e.g., trapping and monitoring), the spatial arrangement of the traps, and other logistics associated with implementing mitigation activities (i.e., costs, topographical challenges, weather-related concerns, cultural and archaeological resources concerns, access, and visual concerns). Trapping and monitoring protocols will be consistent with protocols established by the NPS for managing the Haleakala National Park colony (Bailey pers. comm. 2010; Hodges and Nagata 2001), and will also take into consideration recommendations of other recognized experts in seabird colony management including Ecoworks. Though the likelihood of capturing petrels in traps is very low, Auwahi Wind will also work with DOFAW and the USFWS to develop guidelines for the care, rehabilitation, and release of any captured Hawaiian petrels. Auwahi Wind may need to revise elements of the management plan for the mitigation area over time based on the best available information. Changes to the management activities will be made with approval of the USFWS and DOFAW and updates will be provided as part of the annual report.

As previously identified, Auwahi Wind will conduct post-construction fatality monitoring to assess take of Covered Species. If it is apparent that the take levels specified for Tiers 1 or 2 are likely to be exceeded, Auwahi Wind will begin implementing the next tier of mitigation prior to reaching that next take level. For example, if it appears likely that the Tier 1 take level will be exceeded, Auwahi Wind will begin implementing the Tier 2 mitigation measures prior to reaching the Tier 1 take limit.

Kahikinui

Auwahi Wind will initiate predator control on the parcel of the Kahikinui Forest Project that contains the required number of burrows for both Tier 1 and Tier 2 to ensure a net benefit, as demonstrated by the population projection, and may include Tier 3 depending on burrow distribution. Based on the October 2011 site visit, it is anticipated that an area of approximately 300-600 acres would be managed pursuant to this HCP (Figure 2-6). The actual boundary of the management area will be delineated based on the results of the burrow survey in 2012. All burrows identified in the 2011 petrel survey will be available for the Auwahi Project. Trapping will be conducted for 20 years unless results indicate trapping is no longer required for this population. The benefits of trapping are likely to carry beyond the trapping period because of the time delay before additional cats and mongoose move into the area (Bailey pers. comm. 2010).

For the purpose of this impact assessment Auwahi Wind assumes that predator-proof fencing, should it become a viable option at some point in the future, would be constructed within the management area delineated in Figure 2-6. Based on currently available fence technology, the fence would be approximately 6-7 ft (1.8 to 2.1 m) above ground level with three strands of white polytape incorporated into the fence where the fence poses a potential flight hazard to seabirds (e.g., ridge lines). The corridor along the fenceline where installation activities would occur would be approximately 6 ft (1.8 m) wide and approximately 16,570 ft (5,050 m) long, depending on the final alignment, to enclose an approximately 300 acre (121 ha) area. Vegetation, if present, would be cleared within this corridor. This would result in an area of approximately 2.3 acres (0.9 hectares) where ground disturbance would occur. Site preparation and methods for fence installation depend on the substrate but could involve directly securing the fence to solid surfaces (e.g., pahoeho) with anchor nails or in more dynamic substrates (e.g., soil or cinder) which are more typical of the upper elevations of Kahikinui, excavating a 12- to 18-inch (30- to 46-cm) deep trench in which the bottom edge of the fence would be buried (Hu, pers. comm., 2011). Poles would be installed in 1.5 inch by 12 inch (4 by 31 cm) holes pre-drilled with handheld gas powered rock drills and buried approximately up to approximately 18 to 22 inches (46 to 56 cm) deep. It is assumed that fence materials and equipment would be delivered by truck to a designated helicopter landing sight and then flown by helicopter to the fence corridor. Predator trapping within this fenceline would be conducted as described above.

The timeline for implementing petrel mitigation is outlined in Table 2.2-4.

Table 2.2-4. Estimated petrel mitigation timeline.

Date	Event
Summer 2011	Petrel burrow surveys
Fall 2011	Identify specific mitigation area and predator control method
March 2012	Project construction initiated
Summer 2012	Comprehensive burrow survey
December 2012	Project in commercial operation
Fall 2012 (or prior to vertical construction of WTGs)	Finalize petrel management plan
2013-2031	Initiate and execute predator management and monitoring

ATST Mitigation Site

As described in the ATST HCP, an approximately 328-acre (133-ha) mitigation area surrounding the Haleakala Observatories, adjacent to the western perimeter of Haleakala National Park, will be fenced and is currently being managed by the National Science Foundation (NSF) to compensate for impacts to the Hawaiian petrel. The Kula Forest Reserve and the Kahikinui Forest Project are adjacent properties on the north and south sides of the mitigation area, respectively. Like the Kahikinui mitigation site, the ATST mitigation site, is primarily barren (74 percent), with a smaller component vegetated by Hawaii montane-subalpine dry shrubland (11 percent) and Hawaii alpine dwarf shrubland (1 percent), with the remaining area classified as developed (14 percent). Shrublands are sparsely vegetated with dwarf native shrubs.

Predator control conducted under the ATST HCP consists of short-term cat trapping and rat control around the petrel colony (ATST 2010). Predator control is currently implemented prior to and throughout the petrel breeding season, beginning when the birds return to Haleakala in February until they leave in November. Predator trapping will involve placement of traps on a 164- to 280-foot (50- to 250-meter) or similar appropriate grid within and adjacent to the colony. The placement of traps will be based on topography, access, and the location of burrows, to avoid disturbance or other adverse impacts to petrels. To minimize impacts to petrels, the traps will be checked daily either physically or using a radio transmitter device as described above, if wind conditions permit. If a petrel were to be captured in a trap, the trap will be resituated to minimize the likelihood of any additional capture. In addition to cat trapping, the NSF will also install and maintain a rat control grid within and adjacent to the petrel colony for the 50-year life of the ATST project (ATST 2010).

Burrow monitoring under the ATST HCP will be conducted in accordance with "Standard Operating Procedure for Surveying Uau Burrows" (Hodges 1994, pp. 14-18) and Hodges (2001, p. 311), currently implemented at Haleakala National Park. Consistent with current management, no vehicles will be driven off-road. Petrel burrows within the mitigation area will be monitored at least twice per month for direct and indirect signs of activity and fledging, based on standard definitions provided in the above referenced document.

The ATST HCP assumes that with the implementation of these mitigation measures a net benefit for petrel take under the associated ITP/ITL will be reached 6 to 10 years after construction. At that point, the ATST project would no longer be required to continue predator trapping and burrow monitoring efforts. Under this alternative scenario Auwahi Wind would take over these mitigation activities at the ATST site once a net mitigation benefit for that project has been reached. This alterative could be potentially implemented if Tier 3 mitigation is required or if mitigation benefits achieved as a result of Kahikinui management are insufficient to offset Tier 1 and Tier 2 take. The duration of ongoing maintenance and monitoring would be determined by Auwahi Wind based on the level of mitigation required in coordination with the USFWS and DOFAW.

<u>Projected Benefits</u>

The Kahikinui Forest Project is a long-term effort that, among other goals, seeks to protect and enhance existing petrel colonies and to create and restore petrel habitat on Maui. Through the implementation of predator control measures within the Kahikinui Forest Project (and if necessary, the ATST mitigation site), Auwahi Wind projects that the proposed mitigation strategy will produce/protect enough petrels within the 20 years of mitigation to offset potential take. Therefore, the overall numbers of Hawaiian petrels will not be reduced as a result of the Auwahi Wind project. Predator control will increase survival and reproductive success of the Hawaiian petrel occupying the mitigation site relative to levels that would have occurred in the absence of the mitigation action. In ideal situations, the benefits of the proposed mitigation efforts (e.g., enhanced petrel reproductive success) would be compared to the conditions at a control site. In order for a control site to provide adequate and appropriate baseline data for comparison, the following conditions need to be met: the control site must currently experience the same environmental and biological conditions as the mitigation site (e.g., the same predation pressures); the control site's petrel population needs to have a similar demographic make-up (e.g., age structure) as the mitigation site; and, the control site must not receive any mitigation support over the time period of comparison to the mitigation site (i.e., the control site must remain unmanaged for the duration of Auwahi Wind's period of responsibility). Given that the first two conditions will be difficult to meet on Maui and that meeting the third condition will hamper the recovery of the species at the control site, Auwahi Wind concluded that the best solution is to assess the benefits of the proposed mitigation comparing, based on monitoring results, differences between reproductive success and survival at the mitigation site and the baseline conditions provided in the peer-reviewed literature (Tables 6-5a and b of the HCP). In order to test the assumption that the baseline conditions presented in the HCP are representative of local conditions, Auwahi Wind will compare the results of monitoring at the ATST control site to the baseline population model parameters for the duration of the ATST monitoring. If the conditions at the ATST site differ from the assumptions of the baseline population model, Auwahi Wind will adjust their mitigation targets accordingly, in consultation with DOFAW and USFWS.

A net benefit to the species will be realized by these mitigation efforts because new immigrating adults recruiting into the focal colony will more likely produce offspring than they would in non-managed areas. Additional net benefit to the species will be realized by these mitigation efforts because new immigrating adults recruiting into the focal colony will be producing offspring in this protected environment that have not been accounted for in the population projections. In addition, components of the mitigation efforts (e.g., predator eradication) may continue to benefit the focal colony beyond the term of the ITP/ITL. Finally, the assessment of potential impacts (Section 4.8) assumes that all WTGs will operate continuously (24 hours a day, 7 days a week), and the proposed mitigation measures are based on the potential impacts resulting from these operational considerations. However, Auwahi Wind expects that the WTGs will be curtailed (turned off) on a regular basis between approximately 23:00 and 06:00 hrs (or 29 percent of a 24-hour day) due to the low demand for power from MECO during that time period. This time period partially overlaps with the timing of peak petrel movement activity through the project area (Hamer 2010a). As a result, Auwahi Wind anticipates that the actual amount of take caused by the WTGs likely will be less than estimated in the HCP. Auwahi Wind has not adjusted projected take to account for this reduction in operational activity; rather, the predicted curtailment is presented as support for the notion that the estimated take represents a worst-case scenario and that the probability of triggering Tier 3 take and mitigation is low.

Contingencies

In the event that measured benefits at the Kahikinui Forest Project are not sufficient to cover take under Tiers 2 or 3, should these levels be triggered, Auwahi Wind will focus mitigation efforts on one or more of the alternate mitigation sites described below and shown in Figure 2-1, in consultation with the USFWS and DOFAW. Selection of site and mitigation focus will depend on agency recommendations and timing, such that Auwahi Wind mitigation activities will integrate with and enhance ongoing management actions at the selected site. Selection of a contingency mitigation site will be determined in conjunction with finalization of the petrel management plan. Should mitigation at a contingency site be needed by Auwahi Wind later in the permit term, the contingency sites and activities described below will be considered if they are still available and are not committed to another entity for mitigation at that time.

<u>Additional Management Activities at the Kahikinui Forest Project</u>

If additional mitigation is required for Tier 3, Auwahi Wind will consider implementing rat control, using approved protocols, at the Kahikinui Forest Project in order to increase the reproductive success of the petrels, thereby reducing the number of active burrows required for mitigation. Under this contingency, approximately $50,000 would be provided at the colony for rat control. Subsequent years of rat control use may be needed to achieve mitigation targets and the net benefit to the species.

Haleakala National Park

Another alternative for petrel mitigation would be to provide funding or assist the NPS with management and monitoring efforts of the Hawaiian petrel colony in the crater or another more remote location within Haleakala National Park (Figure 2-2). Currently predator control efforts include established trap lines that are managed along the edges of colonies, the entrance road, and gulches where predators may potentially travel. Under this option, Auwahi Wind would contribute funds toward or assist with implementing predator control and monitoring. Trapping and monitoring protocols would follow the protocols that have already been established by the NPS for managing the colony and being implemented (Hodges and Nagata 2001; Bailey, pers. comm., 2010 and 2011).

DOFAW Pooled Partnership Funding

Should a DOFAW pooled-partnership restoration funding opportunity for petrel mitigation at the Kahikinui Forest Project become available during the term of the HCP, Auwahi Wind will also consider contributing an agreed-upon amount to the partnership in lieu of petrel mitigation at the Kahikinui Forest Project.

Mitigation for Potential Impacts to the Hawaiian Goose

The recovery plan for the Hawaiian goose (USFWS 2004) lists protection and management of habitat, predator control, research, establishment of additional populations, captive breeding, and outreach and education as recovery actions needed to address these limiting factors. Therefore, Auwahi Wind will contribute $25,000 to Haleakala National Park (Park) to build a rescue pen and predator fence to support egg and gosling (and adult) rescue at the Park. Hawaiian geese are particularly vulnerable to predation during nesting and before the goslings fledge and the Hawaiian goose population at the Park is subject to high predation of eggs and goslings by cats, rats, and mongooses. In addition, because of adverse weather conditions at the Park, many eggs and goslings are lost to inclement weather. Funds to support egg and gosling rescue at Haleakala National Park would help the Park better address these issues and is an action recommended by the Nene Recovery Action Group. This contribution of $25,000 is commensurate with the requested take of 5 Hawaiian geese over the 25-year permit term. This management activity will contribute to increasing reproductive success of the Park Hawaiian goose population, and therefore will provide a net benefit to the species.

Mitigation for Potential Impacts to the Blackburn's Sphinx Moth

Auwahi Wind anticipates that direct impacts to larvae and adult Blackburn's sphinx moths will be avoided but that indirect impacts to individuals could occur. Mitigation for Blackburn's sphinx moth was developed based on permanent habitat impacts. As described in further detail in Section 4.8, this proposed mitigation is consistent with the measures identified in the recovery plan for this species (USFWS 2005c). The specific mitigation measures and calculations for mitigation impacts are outlined below.

The Recovery Plan lists planting of aiea as a conservation action for the Blackburn's sphinx moth (USFWS 2005c). Therefore, Auwahi Wind will provide funding to the LHWRP for aiea outplanting in addition to other native species in the Auwahi Forest Restoration Project, where the moth is known to occur (USGS 2006). The LHWRP will restore dryland forests, which will benefit native wildlife in general, and will enhance fitness for Blackburn's sphinx moth by planting approximately 250 stems of aiea per acre of mitigation. Methods would be similar to those previously conducted for the Auwahi Forest Restoration Project (USGS 2006).

The restoration completed for the Blackburn's sphinx moth mitigation will provide a net benefit to the species because native habitat will replace degraded vegetative communities providing no or little habitat for the species. The noxious tree tobacco larval host plant, some of which has been and will be removed consistent with USFWS-approved pre-construction survey protocol to minimize impacts, is being replaced by the native larval host plant aiea. Larval food availability by aiea is among the factors thought to be limiting the Blackburn's sphinx moth (USFWS 2005c). By outplanting 1,500 stems of aiea (250 stems of aiea per acre over six acres), Auwahi Wind's mitigation will result in a significant increase in the availability of Blackburn's sphinx moth larval host plants. This assumption is corroborated by the success of the aiea plantings at the first Auwahi Forest Restoration Project exclosure, which after 5 years resulted in a nearly 50 percent increase in the aiea population (USGS 2006). Moreover, aiea is also considered superior to the non-native host plant because it is more resistant during drought conditions and is longer lived than tree tobacco (USFWS 2005). In addition, the aiea planted in the Auwahi Forest Restoration Project will be protected from the impacts of fire, grazing, and invasive plants. The Auwahi Forest Restoration Project also provides a variety of nectar species for the moth. Finally, tree tobacco is expected to recolonize disturbed areas within the project area following construction. Through natural regeneration on this land, benefits from the mitigation should occur beyond the lifespan of this project.

Mitigation calculations were based on Blackburn's sphinx moth and botanical surveys conducted in March and April 2011. Impacts of the project to Blackburn's sphinx moth occur on degraded habitats, some of which include remnant native plants. Acreage affected by permanent disturbance was separated into degraded habitat with some native species and degraded habitat (Greenlee pers. comm. 2011). Based on this separation, permanent impacts to degraded habitat with some natives will be mitigated at the rate of 2 acres (0.8 ha) restored for every acre of permanent impact; thus, the 0.3 acres of permanent impact to degraded habitat with some native species will result in 0.6 acre (0.2 ha; 0.3 acres x 2 = 0.6 acre) of mitigation. Permanent impacts to degraded habitat will be mitigated at a rate of 0.2 (0.08 ha) of restored habitat for every acre of permanent impact to degraded habitat; thus, the 27.7 acres (11.2 ha) of permanent impact will result in 5.5 acres (2.2 ha; 27.7 acres x 0.2 = 5.5 acres) of mitigation. In total, 6 acres (2 ha) will be targeted for habitat restoration.

Auwahi Wind will provide $144,000 (6 acres x $24,000 per acre) to the LHWRP to restore 6 acres (2 ha) of dryland forest at the Auwahi Forest Restoration Project. The restoration of native habitat at the Auwahi Forest Restoration Project will mitigate any potential direct or indirect impacts associated with the Project for the Blackburn's sphinx moth by protecting and enhancing suitable habitat for this species. The 6 acres would be planted within 3 years of the payment to the LHWRP.

Monitoring and Reporting

Petrel Monitoring

Petrel burrows will be monitored following methods used by NPS. Auwahi Wind will evaluate the number of active burrows and reproductive success on Kahikinui mitigation parcel. Monitoring will occur annually for the first 3 years. An additional 5 years of monitoring will occur at certain points during the life of the mitigation. Actual survey years will be determined in consultation with and with subsequent approval from DOFAW and USFWS, and will depend on information gathered from the initial 3 years and other information gained about petrel biology.

Measured rates of reproductive effort, reproductive success, and adult and juvenile survival at Kahikinui will be compared to vital rates measures at the ATST petrel mitigation control site, pursuant to USFWS request. The National Science Foundation has proposed six years of monitoring at 30 active burrows within this control site which is also located on Haleakalā. This comparison will provide a measure of fledglings and adults accrued. Fledglings accrued will be the net increase in pair productivity of petrels over that of baseline productivity estimates for petrels under unmanaged conditions. Likewise, the adults accrued will be the difference in adult survival rates at the managed site (Kahikinui) over that under unmanaged conditions. Reproductive effort, reproductive success, and juvenile and adult survival rates agreed to by the Agencies may be used in place of control site monitoring data.

Bat Monitoring

Monitoring for Hawaiian hoary bats will occur at both the wind farm site and the Waihou Mitigation Area. Auwahi Wind will conduct bat acoustic monitoring during the first 2 years of operation at the project. Monitoring at the mitigation site may be accomplished by using radio telemetry of Hawaiian hoary bats or similar methods.

Post-construction Monitoring, Wildlife Education, and Incidental Reporting Program

A post-construction monitoring plan (PCMP) would be implemented as a means to document impacts to the Covered Species as a result of operation of the Auwahi Wind project, and to ensure compliance with the authorized provisions and take limitations the ITP and HCP (Appendix D of the HCP). Based on the results of post-construction monitoring, avoidance and minimization measures as outlined in the HCP adaptive management strategy could be modified, or additional measures implemented, as necessary, should project effects differ substantially from what was anticipated. Results of monitoring would provide the basis for estimating project-related take and therefore would also be used to inform the implementation of the HCP mitigation strategy.

Key components of the post-construction monitoring plan include:

- Use of Auwahi Wind technical staff and/or third-party contractors trained by experienced biologists with expertise in wind turbine-bird/bat interaction studies and implementing wind energy post-construction monitoring protocol;
- Standardized carcass searches conducted during the initial 2-year post-construction monitoring period under the operating wind turbines approximately once per week from March through September and then two times per week during the petrel fledging period in October and November (8-week period). In December to February, surveys would be conducted monthly and thereafter as determined necessary based upon the initial monitoring. Search intensity may be modified based on the result of the initial monitoring period;
- Carcass removal and searcher efficiency trials to adjust observed fatality numbers for bias associated with the removal of carcasses by scavengers or other means and the ability of searchers to locate carcasses, respectively;
- A Wildlife Education and Incidental Reporting Program for reporting incidental observations of project-related fatalities within the wind farm site and the generator-tie line made by onsite staff; and
- Downed Wildlife Protocol for the recovery, handling, and reporting of downed wildlife.

Auwahi Wind proposes a long-term monitoring approach consisting of periodic comprehensive monitoring followed by interim years of less intensive monitoring. Comprehensive monitoring would occur every 5 years after the initial 2-year intensive sampling period (i.e., years 7, 12, 17, and 22), resulting in a total of 6 years of comprehensive monitoring during the life of the project. During comprehensive monitoring years, searcher efficiency trials and carcass removal trials would be conducted to determine if any variables have changed over time and if any modifications to search frequency are required. During interim years, assuming trends in the monitoring data provide confidence in the estimate of take, the monitoring effort would be reduced to conducting systematic carcass surveys on a monthly or other less frequent basis.

Auwahi Wind would implement a Wildlife Education and Incidental Reporting program for contractors, project staff members, and other Ulupalakua Ranch staff who are on site on a regular basis. This training enables staff to identify the Covered Species that may occur in the project area, record observations of these species, and take appropriate steps for documentation and reporting when any Covered Species is encountered during construction or operation of the Auwahi Wind project, including when downed birds or bats are found. The Wildlife Education and Incidental Reporting program would facilitate incidental reporting of observations within the wind farm site, as well as within the generator-tie line corridor where Auwahi Wind staff and Ulupalakua Ranch staff are regularly present during the course of normal project and ranch operations. Incidental reporting would inform the post-construction monitoring program of any wildlife fatalities that occur outside of standardized fatality surveys, as well as providing supplementary information on impacts associated with the generator-tie line where standardized post-construction monitoring would not occur. The program would be prepared by a qualified biologist and would be approved in advance by the USFWS and DOFAW. Over the term of this HCP, the program will be updated as necessary.

The program will include wildlife education briefings to be attended by new project staff and other contractors or ranch staff as appropriate. Staff members will be provided with printed reference materials that include: photographs of each of the Covered Species and information on their biology and habitat requirements; threats to the species onsite; and measures being taken for their protection under the HCP. The project Biologist, who conducts post-construction monitoring on site, will coordinate with the Construction Foreman and the project Operations Manager to ensure that personnel receive the appropriate written material.

Staff members will be responsible for responding to and treating wildlife appropriately under all circumstances, including avoiding approaching any wildlife other than downed wildlife and avoiding any behavior that would harm or harass wildlife (including feeding). In conjunction with regular assigned duties, personnel will be responsible for:

- Recording any project-related wildlife incidents;
- Adhering to project area road speed limits;
- Identifying Covered Species when possible (Hawaiian petrel, Hawaiian goose, Hawaiian hoary bat, and Blackburn's sphinx moth) and documenting observations by filing a Wildlife Observation Form; and
- Identifying, reporting, and handling any downed wildlife in accordance with the Downed Wildlife Protocol, including filing a Downed Wildlife Incidence Report form in the PCMP (see Appendix D of the HCP).

2.2.4 Avoidance, Minimization, and Mitigation Measures Associated with Wind Farm Construction and Operation for Other Resources

Table 2.2-5 lists industry standard Best Management Practices (BMPs), project-specific design features, and project plans that the Auwahi Wind has committed to incorporating into the Auwahi Wind project to reduce potential impacts associated with construction and operation. Avoidance and minimization measures specific to individual resource areas, in addition to those already identified above for the Covered Species are also described.

2.2.4.1 Cultural Resources

Design features, measures for avoiding and minimizing impacts to cultural resources, and mitigation measures related to cultural resources are described in detail in Pacific Legacy's Archaeological Inventory Survey (AIS) report (AIS; Shapiro et al. 2011). This AIS has been reviewed and was accepted by the State Historic Preservation Division (SHPD) on June 27, 2011. The AIS report documents sites that are both in and out of the current Area of Potential Effect (APE) because of design changes during the past four years, based on surveys conducted in 2007, 2008, 2010, and 2011 (see Section 3.13 for additional information on surveys). A Supplemental AIS (SAIS), addressing these design changes, has been prepared and was approved by the SHPD on October 17, 2011. The current APE has been designed to avoid the most culturally sensitive areas (religious and/or burial sites). The SAIS reveals that 161 sites, consisting of 638 features, occur within the current APE, based on the most recent archaeological surveys. However, not all individual features associated with these sites are within the APE. These sites have been mapped, described, and photographed. A total of 37 manual test units were excavated. These sites were assessed as significant under criterion "d" (information potential), one site was assessed significant under criterion "c" (for their uniquely high degree of workmanship in their construction), and 17 sites were assessed as significant under criterion "e" (cultural significance). All of the culturally significant sites and the sites assessed as significant under criterion "c" will be avoided by construction and thus preserved. For the remaining sites that were assessed as significant under criterion "d," proposed treatments have been made (see mitigation measures outlined below). A mitigation plan for impacts to cultural resources is included in Appendix C. The SHPD in their review letter stated:

> "We concur with these determinations and also the proposed treatment plans for which sites will be slated for preservation, data recovery (including the type/degree of data recovery) and those sites for which no further work is warranted."

Pacific Legacy finalized the Data Recovery Plan (approved by SHPD on November 3, 2011) for those sites where Data Recovery investigations will take place. Specific pertinent portions of the SAIS are summarized below.

Table 2.2-5. Best Management Practices that Avoid, Minimize, or Mitigate Impacts to Project Environmental Resources

Best Management Practice (BMP)	Geology and Topography	Soils	Natural Hazards	Hydrology and Water Resources	Vegetation	Wildlife	Archeological and Cultural Resources	Traffic and Transportation	Hazardous and Regulated Materials and Wastes	Noise	Air Quality	Visual Resources	Surrounding Land Use and Agriculture	Public and Construction Safety
A Temporary Erosion and Sediment Control (TESC) Plan will be prepared that would be implemented by the construction contractor. The TESC Plan will include standard storm water BMPs such as building during the summer months when rainfall potential is low, using silt fences or hay bales to prevent eroded soil from being transported off-site, and contouring to stop drainage from entering the site and to prevent runoff from entering surface waters.	X	X		X	X	X	X							
To minimize the potential for erosion and impacts to site drainage patterns, Project access roads will be sited to follow natural contours and minimize side hill cuts to the extent possible.	X	X		X			X							
At the Interconnection Substation, a retention basin will be constructed to avoid erosion and eliminate the possibility of degrading downstream waters.	X	X	X	X										
Ditches and culverts and other erosion controls will be implemented to capture and convey storm water in areas of temporary disturbance.	X	X		X			X							
Blasting would be conducted such that it would minimize the creation of excessive slopes.	X	X	X											
During construction, wind erosion will be minimized by using common dust suppression techniques, such as regularly watering exposed soils, stockpiling soils, and stabilizing soils.		X									X			
With the exception of areas where permanent surface recontouring is required, disturbed areas will be restored to pre-existing grades and revegetated.	X	X	X	X	X	X	X					X	X	
Permanent storm water control structures will be installed to prevent erosion where access roads, buildings, storage areas, and parking areas are constructed.		X	X	X										

Table 2.2-5. Best Management Practices that Avoid, Minimize, or Mitigate Impacts to Project Environmental Resources

Best Management Practice (BMP)	Geology and Topography	Soils	Natural Hazards	Hydrology and Water Resources	Vegetation	Wildlife	Archeological and Cultural Resources	Traffic and Transportation	Hazardous and Regulated Materials and Wastes	Noise	Air Quality	Visual Resources	Surrounding Land Use and Agriculture	Public and Construction Safety
To minimize the introduction and spread of invasive plant species, potential off-site sources of materials (gravel, fill, etc.) will be inspected, and the import of materials from sites that are known or likely to contain seeds or propagules of invasive species will be prohibited.					X									
Vehicle operators transporting materials to the proposed project site from off-site will be required to follow protocols for removing soils and plant material from vehicles and equipment prior to entry onto the site.					X	X							X	
The Hawaii Department of Agriculture and Maui Invasive Species Commission will be consulted to establish protocols and training orientation methods for screening invasive species introductions during construction.					X	X							X	
Noisy construction activities (including blasting, if required) will be conducted between 7:00 a.m. and 6:00 p.m., unless further restricted by HDOH noise permits, to reduce the potential impact of construction noise during sensitive nighttime hours.										X				
Equipment and vehicles will be maintained in good working order and will employ adequate mufflers and engine enclosures to reduce equipment noise.									X	X				
Contractors and project staff will implement proper O&M procedures as recommended by product manufacturers.										X	X		X	X
A Fire Management Plan (FMP) will be implemented during construction and operations.			X		X	X	X				X	X	X	X
A Spill Prevention, Containment, and Countermeasures (SPCC) Plan will be prepared that would be implemented by the construction contractor and operations staff. The SPCC will include measures for the safe transport, handling, and storage of hazardous materials and will address security, safety, training, inspections, and spill response.				X					X					

Table 2.2-5. Best Management Practices that Avoid, Minimize, or Mitigate Impacts to Project Environmental Resources

Best Management Practice (BMP)	Geology and Topography	Soils	Natural Hazards	Hydrology and Water Resources	Vegetation	Wildlife	Archeological and Cultural Resources	Traffic and Transportation	Hazardous and Regulated Materials and Wastes	Noise	Air Quality	Visual Resources	Surrounding Land Use and Agriculture	Public and Construction Safety
A site-specific Storm Water Pollution Prevention Plan (SWPPP) will be prepared that would be implemented by the construction contractor to reduce impacts to hydrology, drainage, and surface waters. The SWPPP will contain a description of the characteristics of the site such as nearby surface water, topography, and storm water runoff patterns; identification of potential pollutants such as sediment from disturbed areas, and stored wastes or fuels; and identify BMPs that will be used to minimize or eliminate the potential for these pollutants to reach surface waters through storm water runoff.	X	X		X			X		X					
A Burial Treatment Plan will be prepared and implemented to reduce potential impacts to human burial sites that have the potential to be found at the wind farm site. Additionally, an archeological monitoring plan and a recovery plan will be in effect during construction.							X							
To reduce the risk of earthquake damage, all structural elements of the proposed Project will meet or exceed current building code requirements for the seismic risk on Maui. The current design standard is defined by the 2006 Uniform Building Code.			X											X
A Traffic Management Plan will be prepared and implemented reduce potential impacts to traffic during construction.								X						
A Hazardous Materials and Wastes Management Plan (HMWMP) will be prepared and implemented that details proper procedures for storing and using hazardous materials and storing and disposing of hazardous waste. The plan will contain sufficient detail to address the purpose of the plan and to readily translate into the actions necessary to comply with relevant regulations. The plan would include information about site activities, site contacts, worker training procedures, and a hazardous materials inventory in accordance with Article 80 of the Uniform Fire Code.									X					
A Site Safety Handbook will be prepared for construction and operations and maintenance			X										X	X

Avoidance and Minimization Measures

- The Auwahi Wind project was designed to avoid impacts to sites to the greatest degree possible. Auwahi Wind's design engineers continue to consider construction methods and design modifications that can be adopted to avoid and minimize direct construction impacts to historic properties. Some design modifications include the following:
  - Moving the original location of WTG Pad No. 2 and rerouting the internal access roads connecting WTG pads to avoid significant sites within the APE. If avoidance of remaining sites within the APE is not possible, these sites will be mitigated as appropriate.
  - Implementing the use of spanning bridges to avoid direct impacts to lava tubes that may contain archaeological and cultural resources assessed as historic properties.
  - Avoiding, and thus preserving, all culturally significant sites (criterion "e") and sites assessed significant under criterion "c" during construction.
- Auwahi Wind has prepared, in consultation with the Maui Lanai Island Burial Council and SHPD, a Burial Treatment Plan (approved by SHPD on December 1, 2011) which will be implemented by the construction contractor to properly handle known and suspected burial sites. There are four known burial sites and several potential burial mound complexes in the APE. Features of the Burial Treatment Plan include:
  - Assessment of all confirmed burial sites and other sites possibly containing evidence of human remains.
  - Use of spanning bridges to avoid confirmed burial sites.
  - Measures for interim preservation during construction (protection buffer zones around known and potential burial sites, construction worker awareness training, and onsite archaeological monitoring of all ground-disturbing activities).
  - Measures for long-term preservation of iwi kupuna (ancestral remains) identified in the APE to secure these sites and protect them from vandalism or damage. Preservation-in-place for human burials has been identified as the preferred treatment by the Maui Lanai Island Burial Council. This will be done by sealing the openings of lava tubes, preserving the windbreak wall and cleared area around the site in place, and preserving the complexes of possible burial mounds in place. A small plexiglass plaque will be placed at each sealing wall or gate which will have text in Hawaiian and English to warn any explorer that the area is kapu.
  - Measures for the inadvertent discovery of human remains. These include halting construction in the area of the discovery and immediately contacting SHPD staff to determine the appropriate treatment of remains, which may include preservation-in-place, or disinterment and reburial adjacent to the location of discovery.
- During operation, Auwahi Wind will implement additional measures to minimize the potential for theft and vandalism at recorded historic sites including fencing of sites, development and implementation of a Worker Environmental Awareness Program, and possibly the monitoring and patrolling of significant sites.

Mitigation

The Auwahi Wind project has the potential to adversely affect archaeological resources identified as having 'information potential' (criterion "d" under the NHPA). Considerable effort has been exercised to minimize the impact the project would have on the archaeological resources present in the wind farm site. The purpose of archaeological investigations is not only to inventory what archaeological resources are present and evaluate their significance, but to mitigate any potential adverse effects caused by development through archaeological investigations. Some of the archaeological resources present within the project APE have been fully documented and will not require any further archaeological work; others will require further archaeological investigations in the form of detailed mapping and excavations to retrieve significant information. Once retrieved, the destruction has been mitigated and there is no longer an adverse effect. Appendix C lists the proposed treatment for each feature within the APE. The discussion presented below outlines the treatments that will be used to fully mitigate the impacts to resources that require additional investigation.

Additional detailed mapping and selected subsurface testing will be conducted within several site types including hydrological features, habitation sites, and field system terrace sites. The following descriptions are taken from the AIS for the Auwahi Wind project; site numbers where these mitigation measures will be implemented are listed in the AIS.

Hydrological Features

The AIS revealed numerous instances of intermittent stream channels that had various forms of artificial modification, ranging from check dams (barrages), to stone filled-terraces that appear to be designed to filter water underground, to earth-filled terraces that were probably planting surfaces. The discovery of a range of features indicative of sophisticated water control in Auwahi is a major new contribution to our knowledge of Hawaiian land use practices, and especially noteworthy because it occurs in the context of one of the most arid environments in the Hawaiian Islands, the leeward slopes of southeast Maui in the rain-shadow of Haleakala. Detailed mapping and subsurface testing of representative water control features within the APE will be undertaken in collaboration with a professional geomorphologist or geoarchaeologist who has the technical expertise to assist in interpreting geomorphological and sedimentary evidence for past water flow patterns. High-precision three-dimensional mapping of representative water control features will be conducted to understanding water flow patterns; subsurface excavation will be conducted to understand how these water control features were constructed, the chronology of their construction, and details of their function.

Formal Field System Features

The AIS identified remnant portions of such a regularized field system on the fringes of the sedimentary basin inland of the Puu Hoku Kano cinder cone. Formalized field systems with reticulate grids of planting areas are of interest not only because they reflect a kind of intensive agricultural production upon which the late pre-Contact Hawaiian archaic states depended for their economic basis, but because they imply a level of formal control and management above what would be required strictly for agronomic reasons. The remnants of the field system documented in the APE will be carefully recorded and investigated using a combined archaeological-geomorphological methodology, including high-precision three-dimensional mapping and subsurface investigations to address the critical questions of when this system was constructed and how it functioned. Data from this investigation would be extremely important to the ongoing efforts to understand how surplus production and extraction was affecting the rise of archaic states in late pre-Contact Hawaii.

Settlement Features

In any mitigation plan that is developed for the proposed Project, it will be critical to allocate resources to sample and date a sufficient number of residential features so that sample size effects can be controlled. At this point, other parts of Kahikinui district are represented by more than 160 radiocarbon dates, whereas Auwahi proper has only 14 such dates. A target of 50 radiocarbon samples from individual residential features will be obtained and dated in order to address this question. Such investigations carried out for the Auwahi Wind project would implement protocols similar to those used by Pacific Legacy in their dating of features in the inventory survey.

Household Features

The extensive remains of residential features identified in the Auwahi inventory survey make it clear that there is much potential to gain further insights into Hawaiian household organization and structure in this area. Because Kahikinui was a kuaaina or back country region, the daily lives of its people were unlikely to have been the same as those dwelling near the royal centers such as Wailuku or Hana. With the Auwahi sites, there is an opportunity to investigate the traditional lifeways of a true rural hinterland in ancient Hawaii. Complete excavations will be conducted at two features to assess the cultural content (e.g., portable artifacts and remains such as macrobotanical remains, basalt and volcanic glass lithics, and shell and vertebrate remains) of the sites.

Post-Contact Features

While documentary sources tell us a great deal about these major transformations of Hawaiian economy, society, and politics in the post-contact era, there is still a great deal to be learned from the evidence of archaeology. This is especially true for the most rural regions, such as Kahikinui, which were simultaneously both more resistant (being farther from the sources of foreign influence) and more vulnerable (being at the environmental and economic margins of traditional Hawaiian society and thus the most susceptible to the effects of disease and depopulation) to these agents of change. The archaeological landscape of Auwahi not only incorporates a diversity of features from the pre-Contact period, but also many features that appear to date to the late 18th and 19th centuries. In particular, a series of features situated on aa ridges to the east and west of the sedimentary basin inland of Puu Hoku Kano are suggestive of a substantial community of Native Hawaiians who persisted into the nineteenth century. Careful and detailed investigation of these post-contact archaeological features has the potential to reveal much about the transformation of Hawaiian lifeways in the nineteenth century. Larger areal exposures of a selected few post-contact residential structures will be conducted, in order to be able to obtain fine-grained spatial data on activity patterns which can then be compared with similar data from pre-Contact sites in Auwahi, elsewhere in Kahikinui, and in Hawai‘i. Horizontal excavation or exposure of entire house floors will be undertaken in two or three post-Contact residential features to provide the kinds of spatial data necessary to address this question.

Land Use of the Dryland Forest Region

An important part of the historical record of Auwahi is how this unique dryland forest environment was transformed as a result of these successive phases of human land use and resource exploitation. Investigating this critical aspect of the Auwahi record will require the application of the multidisciplinary perspective of historical ecology. Much of the necessary data can be obtained through the various kinds of field and laboratory investigations outlined above. It is anticipated that the materials recovered from the Data Recovery excavations will yield the data to help address these questions regarding changes to the environment resulting from land use and resource exploitation.

2.2.4.2 Transportation

To avoid, minimize, and mitigate for construction-related impacts to roadway and intersection operations, Auwahi Wind will implement the following mitigation measures:

- A project-specific Traffic Management Plan will be developed in coordination with HDOT and Department of Public Works (DPW).
- Traffic-disrupting deliveries will be scheduled during off-peak times and coordinated with HDOT and DPW to minimize inconvenience to the public.
- Any severe road damage will be expeditiously repaired to prevent hazardous situations for motorists, pedestrians, or bicyclists. Still or video photography will be used to document roadway conditions prior to the beginning of construction to ensure that roads are restored to preexisting conditions or better.

2.2.4.3 Noise

Auwahi Wind will implement the following avoidance and minimization measures related to possible project-related noise impacts:

- Conduct noisy construction activities (including blasting, if required) between 7:00 a.m. and 6:00 p.m., unless further restricted by the Hawaii Department of Health (HDOH) noise permits, to reduce the potential impact of construction noise during sensitive nighttime hours.
- Maintain equipment and vehicles in good working order and use adequate mufflers and engine enclosures to reduce equipment noise.
- Establish a toll-free telephone number for receiving questions or complaints during construction and operations, and implement and maintain a noise complaint review process to manage residents' or others' queries and complaints as they arise. Complaints will be logged and investigated on an individual basis to facilitate resolution of the issue.

2.2.4.4 Visual Resources

Auwahi Wind will implement the following avoidance and minimization related to potential visual and aesthetic impacts:

- Keep construction time to a minimum.
- Remove construction debris.
- Locate construction staging and storage areas away from adjacent local roads.
- Comply with all required setbacks from roads and residences.
- Build WTGs with uniform design, speed, color, height, and rotor diameter.
- Locate the WTGs in strings to improve aesthetics by providing a more uniform looking development.

- Place much of the project's electrical collection system underground, minimizing the Project's visual impacts.
- Use a low-reflectivity finish for substation equipment to minimize its visibility.
- Use dull gray porcelain insulators to reduce insulator visibility.

To help mitigate impacts to nighttime views, WTG lighting (aviation warning lighting) would be kept to the minimum recommended by the FAA guidelines (FAA 2007) and allow nighttime lighting of perimeter WTGs only, at a maximum spacing of 0.8 kilometer (0.5 mile). Synchronized, medium–intensity, pulsing red strobe lights will be used at night, rather than white strobes or steady burning red lights. While complying with FAA lighting regulations, Auwahi Wind will seek to minimize the number of WTGs that must be equipped with lights.

2.3 ALTERNATIVE 3: REDUCED PERMIT TERM

Similar to the Proposed Action (Alternative 2), Alternative 3 includes the issuance of an ITP to authorize incidental take of the Covered Species (see Table 2.3-1) in association with construction and operation of the Auwahi Wind project and implementation of the proposed HCP. However, under Alternative 3, the term of the ITP, and project operating period (see Section 2.3.1 for additional detail), would be 21 years rather than 25 years identified under the Proposed Action. Thus, there would be a lower level of authorized take for the Hawaiian petrel and Hawaiian hoary bat compared to the Proposed Action. The authorized level of take for the Hawaiian goose and Blackburn's sphinx moth under Alternative 3 would be the same as under the Proposed Action, because the likelihood of occurrence in the project area is low (Hawaiian goose) warranting one take level and because impacts would occur during construction (moth) and therefore, would not differ between alternatives. Covered activities would be similar to the Proposed Action however mitigation would be reduced due to the lower take levels authorized under this alternative (see Section 2.3.2 for additional detail).

Table 2.3-1. Requested ITP authorization for ESA-listed species under Alternative 3.

Species	Requested Take Over the 21-year HCP Period
Hawaiian petrel	Tier 1: 17 adults; 6 chicks
	Tier 2: 28 adults; 10 chicks
	Tier 3: 55 adults; 19 chicks
Hawaiian hoary bat	Tier 1: 4 adults; 2 young
	Tier 2: 8 adults; 3 young
	Tier 3: 16 adults; 6 young
Hawaiian goose	5 adults
Blackburn's sphinx moth	6 acres

Take levels under Alternative 3 for the Hawaiian petrel and Hawaiian hoary bat were calculated by multiplying the estimated annual fatality rates for each species (see Section 4.8.2.1) by 21 years, and rounding up to the nearest whole number. Note that for bats, a maximum annual fatality rate higher than the predicted maximum annual rate was used to account for uncertainty surrounding the prediction of take and the estimation of actual mortality for this species (see Section 4.8 for additional discussion). Proposed tiers for take and mitigation were defined the same way as under the Proposed Action.

2.3.1 Description of the Auwahi Wind Project under Alternative 3

Details associated with construction and operation of the Auwahi Wind project would be the same, as described under Alternative 2, Proposed Action. Alternative 3 would provide Auwahi Wind with less operational flexibility than the Proposed Action during the construction, operation, or decommissioning period. The Proposed Action conservatively covers an approximately 1 year construction period, the minimum 20-year operating period of the wind farm and an additional 4 years of operation if the life of the turbines expands beyond 20 years before decommissioning, whereas Alternative 3 only covers one year for construction and a maximum of 20 years for operation. Should additional years of decommissioning be required, or should Auwahi Wind choose to extend the wind farm operating period, Auwahi Wind would be required to request a major amendment to extend the term of its ITP.

2.3.2 Conservation Measures under Alternative 3

Avoidance and minimization measures described above under the Proposed Action would also apply to Alternative 3 (Section 2.2.3.1), as would mitigation locations and activities (Section 2.2.3.2). However, due to the lower take level for Alternative 3 for the Hawaiian hoary bat and Hawaiian petrel (Table 2.3-1), mitigation requirements under the HCP would also be reduced for these species. For these species mitigation would be reduced proportionally. For example, for the Hawaiian hoary bat a smaller portion of the Waihou Mitigation Area would be fenced, resulting in less ground disturbance along the fenceline than under the Proposed Action. Likewise, Alternative 3 would involve conducting predator control (trapping) for fewer burrows and years. As noted above, Hawaiian goose and Blackburn's sphinx moth mitigation would remain the same as under the Proposed Action. All other details associated with construction and operation of the Auwahi Wind project would be the same, as described in Section 2.2.

2.4 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

Other alternatives that were preliminarily identified as being viable but which were subsequently dismissed and not carried forward for detailed analysis are discussed below.

2.4.1 Off-island Mitigation Alternative

Under the Off-island Mitigation Alternative mitigation for the Hawaiian petrel would occur outside of Maui. Under this alternative, Auwahi Wind would provide funding to Hawaii Volcanoes National Park (HVNP) on Hawaii Island for management of the petrel colony at Mauna Loa. The main colony currently supports approximately 90 petrel burrows of which 60 are active; there are also two subcolonies totaling 30 active burrows that are currently unmanaged. Construction of a predator-proof fence around the main colony has been proposed but funding had not been secured (Hu, pers. com, 2011). If this alternative were executed, Auwahi Wind would provide funding to HVNP toward fence installation, based on the level of mitigation required in coordination with the USFWS and DOFAW, plus additional funding for annual monitoring and maintenance of the fence. If the fence were to be constructed by the time mitigation at the Mauna Loa site is needed, Auwahi Wind would provide funding to the HVNP to implement predator control and burrow monitoring at the two outlying subcolonies. The duration of predator control and burrow monitoring required for

Auwahi Wind under this alternative would be determined based on the level of mitigation required in coordination with the USFWS and DOFAW.

This alternative was initially considered because Mauna Loa supports a sufficient number of petrel burrows for mitigation activities to produce the required benefits to compensate for the requested take authorization, and it is already the subject of an established petrel management program. Thus, it provided a level of comfort in that there is an existing level of knowledge of the population. However, because take authorization under the ITP would impact the Maui petrel population, mitigation directly aimed at benefiting petrels on Maui is more appropriate. Therefore, the Off-island Mitigation Alternative is not considered further here.

2.4.2 Alternative Project Sizes

The state Final EIS for the Auwahi Wind project describes the variations in the generating capacities that have been considered throughout the planning phase of the proposed project (Tetra Tech 2011). However, the amount of wind-generated energy that the existing electrical grid can accept is limited. Consequently, MECO has determined that the grid can accept no more than approximately 21 MW of energy, as is currently proposed. A further reduction in generating capacity would reduce take levels but would not be economically feasible for Auwahi Wind to develop the project. That is, from Auwahi Wind's standpoint, the costs of constructing and operating the project would outweigh the benefits of power production. Accordingly, the generating capacity of the proposed project was determined to be the appropriate project size, and alternative project sizes were eliminated from further evaluation.

Initially, Auwahi Wind considered three WTG models: the 1.5-MW GE, 2.3-MW Siemens, and 3.0-MW Siemens models. The dimensions of the General Electric (GE) and Siemens WTGs differ, with tower heights of 262 ft (80 m) and blade lengths ranging from 135.3 to 166 ft (41.25 to 50.5 m). Total height from ground level to the tip of the blade would range from 398 ft (121.3 m) to 428 ft (130.5 m). The dimensions of the two Siemens' WTGs are the same; however, the 3.0 WTG is a gearless direct-drive machine that is more efficient than the 2.3 WTG, which has a gear box. Due to their different capacities, each WTG model would result in a different numbers of turbines required to meet the 21-MW generating capacity of the wind farm: 15 1.5-MW GEs, 10 2.3-MW Siemens, and 8 3.0-MW Siemens. Final turbine model selection was based on constructability, reliability, performance, availability and environmental impacts. Ultimately, the 1.5-MW GE and 2.3-MW Siemens models were not selected by Auwahi Wind because they would be less efficient and would result in greater impacts, including greater levels of take than the 3.0-MW Siemens model. Therefore, this alternative was not considered in detail in the EA.

3.0 AFFECTED ENVIRONMENT

This section describes the existing physical, biological, and socioeconomic conditions of the proposed project area. Information on the affected environment within the proposed mitigation site at Kahikinui (described in Section 2.2.3.2) was derived in part from the Final EA for the Kahikinui Koa Preservation and Restoration project (DOFAW portion of the Kahikinui Forest Project adjacent to DHHL land; DOFAW 2004) and the Leeward Haleakala Watershed Restoration Partnership Management Plan (covers both DHHL and DOFAW lands; LHWRP 2006). Relevant information is summarized here as appropriate. Information on the existing conditions at the ATST mitigation site, a contingency mitigation option for petrels, is provided in the recent environmental assessment for the ATST HCP (NSF 2010). Existing conditions within Haleakala National Park where funding for Hawaiian goose mitigation may be applied or where predator control at the petrel colony may be conducted (a contingency mitigation option for petrels) are provided in the Haleakala National Park Resource Overview (Aruch 2006).

3.1 CLIMATE

Climate refers to the average weather conditions in a region over a long period of time. The climate of a location is affected by its latitude, elevation, and proximity to the ocean. Climatic regions are typically characterized by temperature, humidity, wind patterns, and rainfall. The analysis area for purposes assessing climate impacts is the leeward side of Maui.

Hawaii's climate is characterized by two seasons: summer (May through September) and winter (October through April). In general, the islands have relatively mild temperatures and moderate humidity throughout the year (except at high elevations), with persistent northeasterly trade winds and infrequent severe storms. However, summer is typically warmer and drier, with minimal storm events. The trade winds are prevalent 80 to 95 percent of the time during the summer months, when high pressure systems tend to be located north and east of Hawaii. During the winter months, the high pressure systems are located farther to the south, thereby decreasing the prevalence of the trade winds to about 50 to 80 percent of the time (WRCC 2009a). The prevailing wind direction is from the east. Based on data recorded between 1955 and 2009, the average annual rainfall in the vicinity of the Auwahi Wind project is 30.9 inches (78.5 centimeters), with monthly totals ranging between 1.6 inches (4.1 cm) in August to 4.9 inches (12.4 cm) in January (WRCC 2009b). This region has a narrow range of diurnal temperatures, with daytime temperatures in the 70s to 80s (degrees Fahrenheit) and nighttime temperatures in the 60s to 70s.

3.2 GEOLOGY AND TOPOGRAPHY

Geologic resources consist of the earth's surface and subsurface materials. Topography refers to an area's surface features including its shape, height, and depth. The analysis area for assessing impacts to geology and topography includes those areas where ground-disturbing activities from the Auwahi Wind project would occur.

Maui is the second largest of the Hawaiian Islands and is 48 miles (77 km) long by 26 miles (42 km) wide, for an area of 728 square miles (1,886 square km). The island is composed of two volcanic mountains, Haleakala and West Maui, separated by a low-lying isthmus that was created as the lava from Haleakala flowed into West Maui. Haleakala forms East Maui, and is 10,025 ft (3,056 m) above sea level (ASL) and 33 miles (53 kilometers) across. Volcanic activity at Haleakala in the past 30,000 years has occurred along the southwest and east rift zones, with approximately 10 eruptions in the past 1,000 years (USGS 1996a). Area of geologic importance as defined in the North American Stratigraphic Code (AAPG 2005) or other unique geologic features are not found near the Auwahi Wind project. Similarly, mineral resources of economic value to the region and residents of the state do not occur near the project.

In general, the topography of this region is steep and rugged, as is common on the slopes of shield volcanoes. The wind farm site ranges in elevation from approximately 1,600 ft (488 m) ASL on the northern edge to 200 ft (70 m) ASL on the southern edge, which equates to a slope of an approximately 14 percent (Figure 3-1). The slope is fairly uniform across the site, with the exception of Puu Hokukano, which rises to approximately 1,460 ft (445 m) ASL near the center of the wind farm site, approximately 250 ft (76 m) above the surrounding terrain. The generator-tie line would extend from the wind farm site to an elevation of approximately 960 ft (293 m) ASL at the existing Wailea substation. The generator-tie line would have a maximum elevation of approximately 4,400 ft (1,341 m) ASL as it crosses the southwest rift zone. Papaka Road, one of the construction access roads, ranges from approximately 80 ft (24 m) ASL at its western end to approximately 1,780 ft (543 m) ASL at its eastern end. The eastern end of Papaka Road connects with Upcountry Piilani Highway, which drops to approximately 1,608 ft (490 m) ASL at the entrance to the wind farm site. Elevation of the portion of the Kahikinui Forest Project where mitigation is proposed ranges from approximately 6,500 to 9,000 ft (1,980 to 2,745 m) ASL. The Auwahi Forest Restoration Project is located at approximately 3,900 ft ASL. The Waihou Mitigation Area ranges in elevation from approximately 4,820 to 5,580 ft (1,470 to 1,700 m) ASL.

The results of the preliminary geotechnical study indicate that the geologic profile underlying the wind farm site consists primarily of recent basalt flows of the Hana Volcanic series, which is considered to be suitable substrate for construction of the Auwahi Wind project (Black & Veatch 2008). A detailed geotechnical investigation would be conducted prior to construction to confirm the absence of subsurface voids and buried soils in the footprint of the proposed project facilities, and the design would be modified to account for detected voids. The geologic profile underlying the mitigation sites, which are located in the western portion of the Kahikinui District also consist of young lava flows of the Hana Volcanic Series, characterized by rugged, unweathered or barely weathered surfaces lacking significant stream incision (Kirch et al. 2004).

3.3 SOILS

Soils are unconsolidated surface materials that form from the weathering of underlying bedrock or other parent material. Soil drainage, texture, strength, shrink and swell potential, and rates of erosion affect the suitability of the ground to support manmade structures and facilities. In combination with other factors (e.g., climate and terrain), these characteristics are also important considerations for soil productivity and suitability for cultivation. The analysis area for assessing potential impacts to soils includes all areas to be disturbed by construction of the Auwahi Wind project.

According to the Natural Resource Conservation Service (NRCS) Soil Survey (Foote et al. 1972), the soils in the analysis area consist predominantly of the Oanapuka Series (OED), with some areas of very stony land (rVS) and lava flows (rLW) and a small inclusion of cinder land (rCl) on and directly adjacent to Puu Hokukano. The generator-tie line and Papaka Road traverse a broad spectrum of vegetation types over a range of elevations, which is reflected by a wide variety of soil types. Each soil type is briefly summarized in Table 3.3-1.

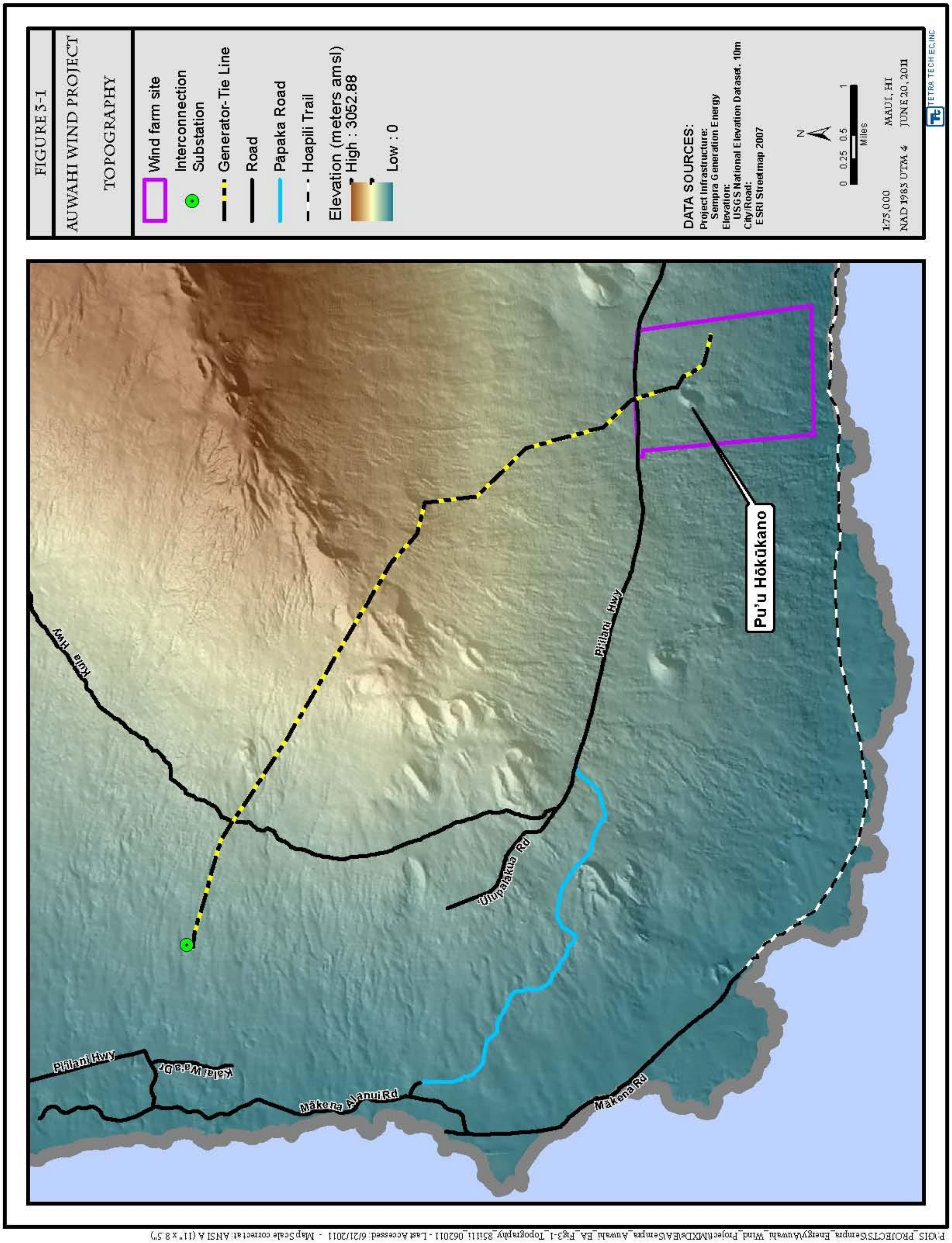


FIGURE 3-1
AUWAHI WIND PROJECT
TOPOGRAPHY
Wind farm site
Interconnection Substation
Generator- Tie Line
Road
Pāpaka Road
Hoapili Trail
Elevation (meters amsl)
High : 3052.88
Low : 0
DATA SOURCES:
Project Infrastructure:
Sempra Generation Energy
Elevation:
USGS National Elevation Dataset, 10m
City/Road:
ESRI Streetmap 2007
N
0 0.25 0.5 1
Miles
1:75,000
NAD 1983 UTM 4
MAUI, HI
JUNE 20, 2011
TETRA TECH EC, INC
Pu'u Hōkūkano
Piilani Hwy
Kula Hwy
'Ulupalakua Rd
Pi'ilani Hwy
Kalai Waa Dr
Mākena Alanui Rd
Mākena Rd

Table 3.3-1. Soil types in the analysis area.

Soil Name	Slope (%)	Description
Oanapuka extremely stony silt loam (OED)	7-25	Well drained, very stony soils on low uplands; developed in volcanic ash and material derived from cinders
Very stony land (rVS)	7-30	Areas where 50 to 90 percent of the surface is covered with stones and boulders
Lava flows, aa (rLW)	—	Consists of young lava flows
Cinder land (rCI)	—	Areas of bedded magmatic ejects; mixture of cinders, pumice and ash
Very stony land (rVS)	7-30	Areas where 50 to 90 percent of the surface is covered with stones and boulders
Uma rocky loamy coarse sand (URD)	7-25	Excessively drained, sandy soils on intermediate mountain slopes, with rock outcrops over 5- to 10 percent of the surface
Uma loamy coarse sand (UME)	15-40	Excessively drained, sandy soils on smooth, intermediate mountain slopes
Lava flows, aa (rLW)	—	Consists of young lava flows
Uma loamy coarse sand (UMF)	40-70	Excessively drained, sandy soils on smooth, intermediate mountain slopes
Ulupalakua silt loam (ULD)	7-25	Soil on smooth, intermediate mountain slopes
Io silt loam (ISD)	7-25	Well-drained soils on smooth, low mountain slopes
Kula very rocky loam (KxbE)	12-40	Well-drained soils on uplands with rock outcrops over 10- to 25 percent of the surface
Kamaole very stony silt loam (KGKC)	3-15	Well-drained soils on uplands; developed in volcanic ash
Kula loam (KxD)	12-20	Well-drained soils; nearly free of cobblestones
Oanapuka extremely stony silt loam (OED)	7-25	Well-drained, very stony soils on low uplands
Makena loam, stony complex (MXC)	3-15	Well-drained soil on upland; developed in volcanic ash
Lava flows, aa (rLW)	—	Consists of young lava flows
Very stony land (rVS)	7-30	Areas where 50 to 90 percent of the surface is covered with stones and boulders
Kula very rocky loam (KxbE)	12-40	Well-drained soils on uplands with rock outcrops over 10 to 25 percent of the surface
Io silt loam (ISD)	7-25	Well-drained soils on smooth, low mountain slopes
Kaipoipoi loam (KDIE)	7-40	Well-drained soils on upland; developed in volcanic ash on moderately weathered basalt and andesite
Puu Pa very stony silt loam (PZVE)	7-40	Well-drained soils developed on volcanic ash

Soils found within the wind farm site and Papaka Road are considered to among the least productive soils by the University of Hawaii Land Study Bureau (1967); soils along the eastern half of the generator-tie line are similar to the wind farm site, and those along the western half are only slightly more productive.

Agricultural Lands of Importance to the State of Hawaii, (ALISH), classify agricultural lands as prime, unique agricultural land, or other important agricultural land. Most of the analysis area is not classified as agricultural land by ALISH. The western portion of the generator-tie line and two small segments of Papaka Road are classified as "Other Important Agricultural Land," agricultural land of state-wide or local importance for the production of food, feed, fiber, and forage crops. The lands in this classification are important to agriculture in Hawaii yet they exhibit properties such as seasonal wetness, erodibility, limited rooting zone, slope, flooding, or droughtiness that exclude them from the prime or unique agricultural land classifications.

Soils found in the upper elevations of the Kahikinui Forest Project consist of the cinderland (rCI; NRCS 2011). Soils in the Waihou Mitigation Area consist of the Kaipoipoi loam (KDIE; Cornwell Spring and Kaumaea Loko parcels), Uma loamy coarse sand (UMF; Duck Ponds and Puu Makua parcels), very stony land (rVS; Puu Makua parcel), and lava flows (rLW; Puu Makua parcel)(NRCS 2011). Soils in the Auwahi Forest Restoration Project consist of Puu Pa very stony silt loam (PZVE; NRCS 2011). The Kaumaea Loko, Cornwell Spring, and a portion of the Puu Makua parcels are classified by ALISH as "Other Important Agricultural Land."

3.4 NATURAL HAZARDS

A natural hazard is a naturally occurring event that could negatively affect people, infrastructure, and the environment. Many natural hazards can be triggered by another event, though they may occur in different geographical locations (i.e., an earthquake can cause a tsunami in an entirely different geographic area). Because natural hazards occur on a regional scale, the analysis area for impacts associated with natural hazards includes all of east Maui.

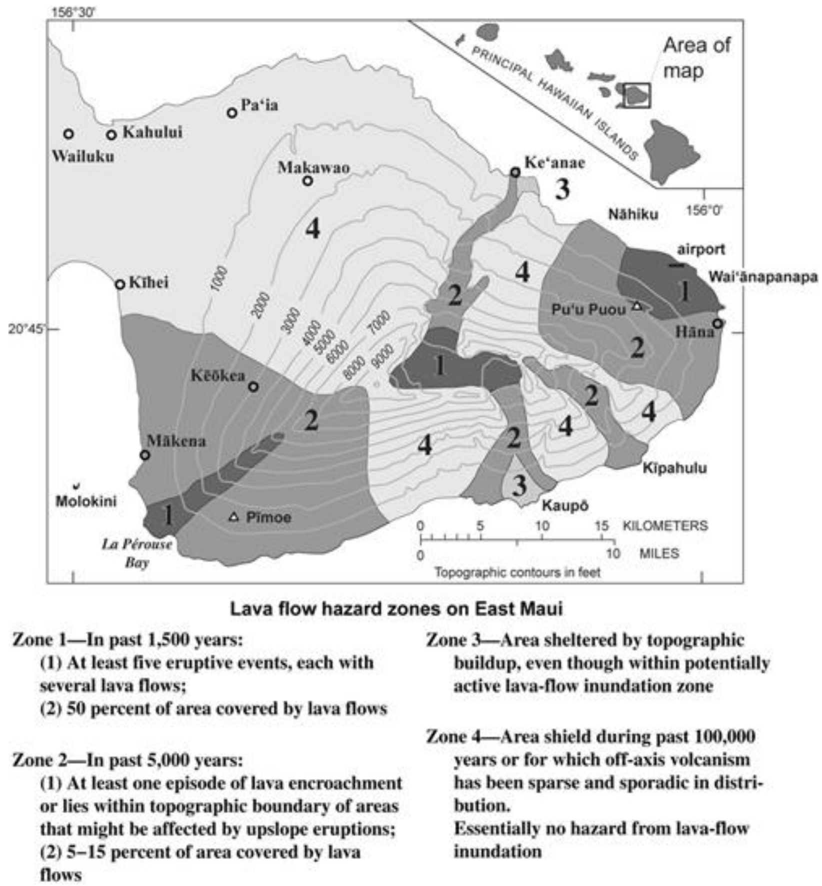
Although uncommon, a variety of natural hazards can affect Hawaii, including hurricanes and tropical storms, tsunamis, volcanic eruptions, earthquakes, floods, and wildfires. Within the analysis area, there is potential for all of the hazards listed above to occur.

Hurricanes and Tropical Storms – The Central Pacific Hurricane season runs from June 1 to November 30. Only five hurricanes have affected the islands over the last 50 years (Bussinger 1998; County of Maui 2010a). Tropical storms occur more frequently than hurricanes, and typically pass sufficiently close to Hawaii every 1 to 2 years to affect the weather in some part of the Islands (WRCC 2009a). No hurricane or tropical storm has ever made landfall on the island of Maui (or Maui County, which includes Kahoolawe, Lanai, Molokai, and Maui Islands) (County of Maui 2010a).

Tsunamis – Tsunamis are large, rapidly moving ocean waves triggered by disturbances around the Pacific Rim (i.e., teletsunamis) and by earthquakes and landslides near Hawaii (e.g., local tsunamis). No portion of the Auwahi Wind project or the mitigation sites are in the Civil Defense Tsunami Evacuation Zone (NOAA 2010).

Volcanic Eruptions – Haleakala is the only active volcano in Hawaii not located on Hawaii Island. The last eruption of Haleakala is believed to have occurred around 1790, along the lower southwest rift zone. Recent geologic mapping suggests that this rift zone may have erupted as many as five times in the last 900 years, producing 8.7 square miles of lava flows (USGS 1996a).

Lava-flow hazards are rated on a scale of 1 through 9, with 1 being the zone of highest hazard and 9 being the zone of lowest hazard. Lava-flow hazard zones and the corresponding numbers are unique to each island. The wind farm site is in Zone 2; the proposed generator-tie line corridor is mostly in Zone 2, with a small portion in Zone 1; the interconnection substation is in Zone 2; the construction access route is mostly in Zone 2 with a small section in Zone 1; the mitigation sites are in Zone 2 (Figure 3-2).



Source: USGS (2010)

Figure 3-2. Lava flow hazard zones on east Maui.

Earthquakes and Seismicity – Studies by the University of Hawaii suggest that Maui can expect a magnitude 3 to 5 earthquake to occur approximately every 2 to 5 years, and a magnitude 7 earthquake to happen approximately every 250 years (USGS 1996b). The Uniform Building Code (UBC) was developed to address building codes in a specific area to account for seismic hazards. The UBC's seismic hazard is based on expected ground shaking strength and probability of specified time (USGS 2001). Hawaii has four UBC seismic hazard zones. According to the U.S. Geological Survey (USGS), Zone 0 means that there is "no chance of severe ground shaking" and a seismic hazard rating of 4 means that there is a "10 percent chance of severe shaking in a 50-year interval" (USGS 2001). G-force is used to quantify the shaking (USGS 2001). All of Maui County has a UBC seismic risk zone ranking of 2B. The 2006 version of the International Building Code will be used for design of structural components of the proposed project (IBC 2006).

Lightning Strikes and Wildfire – In Hawaii, lightning does not occur as often or is not as severe as in many continental areas (NOAA 2007). It would therefore be uncommon for a lightning strike to start a fire in the vicinity of the Auwahi Wind project.

Wildfire occurs on all of the major Hawaiian Islands, with human activity the primary cause (Pacific Disaster Center 2008). Hawaii's native ecosystems are not adapted to wildfire; therefore, wildfire can result in impacts to native species and increased coverage by non-native invasive species. Other effects include soil erosion, increased runoff, and decreased water quality.

Based on the recollection of Ulupalakua Ranch personnel, there have been about six fires on or near Ulupalakua Ranch land within the past 6 years. With the exception of one unknown fire source, all of these fires were started by humans—most of them intentionally and some by carelessness (e.g., discarded cigarette from moving vehicle) (Konaaihele 2010).

Flooding – Potential flood hazards are identified by the Federal Emergency Management Agency (FEMA) National Flood Insurance Program and are mapped on the Flood Insurance Rate Maps. According to 2009 FEMA data, the flood zone designation for most of the Auwahi Wind project and all of the mitigation sites is Flood Zone X. Zone X is assigned to those areas that are determined to be outside the 1 percent annual chance floodplain; FEMA 2009). A portion of the wind farm site is designated as Flood Zone A, which corresponds to those areas determined to be subject to inundation by the 1 percent annual chance flood (FEMA 2009); however, development is not proposed in this area.

3.5 HYDROLOGY AND WATER RESOURCES

Hydrology and water resources include groundwater, surface water features, and other resources such as watersheds and floodplains. Groundwater refers to the subsurface hydrologic resources, often described in terms of depth to the aquifer or water table, water quality, and surrounding geologic composition. Surface water features include lakes, rivers, streams, and wetlands. For the purposes of this analysis, the analysis area for hydrology and water resource includes the watersheds that coincide with the area covered by the HCP.

The western half of the wind farm site is in the Kanaio watershed and the eastern half is in the Kipapa watershed. The generator-tie line spans the Kanaio and Wailea watersheds, with the boundary located along the southwest rift zone. Papaka Road crosses through the Kanaio, Ahihi Kinau, Mooloa and Wailea watersheds. The portion of the Kahikinui Forest Project where petrel mitigation is proposed is in the Kipapa watershed. The Auwahi Forest Project and the southeastern portion of the Waihou Mitigation Area are in the Kanaio watershed. Most of the Waihou Mitigation Area is in the Wailea watershed. These watersheds range in size from 1,200 acres to 22,000 acres; perennial streams do not occur in these watersheds (Hawaii Institute of Marine Biology 2006).

Groundwater – The proposed wind farm site, the Auwahi Forest Restoration Project, the western half of the Kahikinui Forest Project, and the eastern portion of the Puu Makua parcel of the Waihou Mitigation Area are located in the Lualailua aquifer subunit (aquifer code 60603) of the Kahikinui aquifer unit (aquifer code 606) and has a sustainable yield of 11 million gallons per day (MGD) (CWRM 2008). The Laulailua aquifer consists of an upper unconfined aquifer and lower basal aquifer; both are suitable sources of drinking water with moderate to high vulnerability to contamination (Mink and Lau 1990). The eastern half of the Kahikinui Forest Project is located in the Nakula aquifer subunit (aquifer code 60602) of the Kahikinui aquifer unit which has a sustainable yield of 7 MGD. The Nakula subunit consists of an unconfined basal aquifer, an unconfined high-level perched aquifer, and an unconfined upper dyke impounded aquifer (Mink and Lau 1990). The generator-tie line and Papaka Road both cross the Kamaole aquifer (aquifer code 60304) of the Central hydrologic unit (aquifer code 603), which has a sustainable yield of 11 MGD (CWRM 2008). The western portion of the Waihou Mitigation Area is also located in the Kamaole subunit. The Kamaole subunit consists of an upper dyke impounded aquifer and a lower basal unconfined flank aquifer. The upper unconfined aquifer has potential drinking water use and has a moderate to high vulnerability to contamination. The basal aquifer is not used as a drinking water source (Mink and Lau 1990).

Given the steep terrain and lack of surface water features throughout the analysis area, it is believed that the groundwater levels are deep below the ground surface. No groundwater was encountered in the borings (ranging from 32 ft to 41 ft [9.8 m to 12.5 m] deep) conducted during the geotechnical investigation (Black & Veatch 2008). Surface soils in the analysis area consist of well-drained stony soils, young lava flows, and exposed bedrock as detailed in Section 3.3 – Soils. These soils, and the limited existing development of impervious structures such as buildings, roads, and other infrastructure, allow for substantial amounts of precipitation to infiltrate into the groundwater system beneath the analysis area.

Surface Water – A few natural springs and created ponds occur within the Waihou Mitigation Area. However, there are no wetlands or other perennial surface water features within the analysis area. No "waters of the U.S." are in or near Auwahi Wind project that are subject to jurisdiction under Section 404 of the Clean Water Act (CWA; David and Guinther 2011). The Auwahi Wind project is subject to compliance with CWA Section 402, the National Pollutant Discharge Elimination System (NPDES), for construction activities. There are several broad drainage swales along Papaka Road that are generally grass-dominated and have no defined bed and bank features that demonstrate conveyance of storm water runoff from upland areas. There is also a gully between Makena (near the proposed interconnection substation) and Lualailua Hills (east of the wind farm site) along the western edge of the wind farm site, west of the WTG pads and internal access roads. These drainage features are characterized by low-volume, infrequent, or short duration flows. They carry water only during exceptional storms, with flow ceasing soon after the rainfall ends.

3.6 VEGETATION

The following section presents a general overview of vegetation communities and rare or special status plant species. Sources of information used in the preparation of this analysis include state and federal agency data as well as the results of project-specific surveys, including the Hawaiian Biodiversity and Mapping Program (data on land cover and species occurrences acquired in May 2010), and botanical surveys conducted for the project in 2007, 2010, and 2011 (David and Guinther 2011; Guinther and Montgomery 2011). The analysis area for vegetation impacts includes the proposed wind farm site and interconnection substation, the area within a 0.25-mile [0.4-km] buffer around the generator-tie line corridor centerline and construction access route (Papaka Road), as well as each of the mitigation areas.

Vegetative Communities – In 2007 and 2010, project biologists mapped vegetation communities within the portion of the analysis area where Auwahi Wind project facilities are proposed and searched for federally or state-listed species, other special status species, and rare native plant species (David and Guinther 2011, Appendix B). A follow up botanical survey was conducted in 2011 to capture rainy season conditions and previously unsurveyed areas now included in the project footprint due to refinements in the project design. Botanical surveys conducted in 2007, 2010, and 2011 documented 59 plant species within the wind farm site, 136 species adjacent to and within the generator-tie line corridor, and 98 species along the construction access road, including some rare or uncommon endemic (native to Hawaii and found naturally nowhere else) and indigenous (native to Hawaii but not unique to the Hawaiian Islands) species. A list of plant species observed during the botanical surveys is included in Appendix B; one additional species, Kooloaula or red ilima (*Abutilon menziesii*), was documented in surveys subsequent to the preparation of this report. Botanical surveys would be conducted in the mitigation sites prior to commencement of mitigation activities.

The Auwahi Wind project is located on the leeward side of Haleakala in the Hawaiian dry tropical forest ecoregion. The analysis area primarily consists of disturbed grasslands and shrublands used for grazing, with scattered remnants of the native dryland forest and shrublands that historically occupied the entire area (Figure 3-3). These remnants include several groves of native wiliwili (*Erythrina sandwicensis*; endemic to Hawaii) mixed with non-native species including kiawe (*Prosopis pallida*) and koa haole (*Leucaena leucocephala*). The intactness of the understory plant community in these groves, or the extent to which they support the original suite of native species, depends on the underlying substrate and grazing pressure. In general, portions of the analysis area located on recent lava flows coincide with areas of native vegetation (David and Guinther 2011, Appendix B). Most of the wiliwili groves in the analysis area have a degraded understory primarily consisting of non-native shrubs or a mixture of grasses and shrubs, supporting few native plant species. Table 3.6-1 summarizes the general vegetation communities within the portion of the analysis area where vegetation was mapped.

Table 3.6-1. Vegetation communities within the analysis area.[1]

Vegetation Community	Acres	Percent of Analysis Area
Scrub/shrub	2,241	38
Grassland/pasture	2,035	35
Mixed native forest	745	13
Savanna	481	8
Disturbed/developed	256	4
Secondary/non-native forest	36	1
Restoration area	33	1
Total	5,825	100

Note: Vegetation communities were mapped during 2010 botanical surveys (David and Guinther 2011).

[1] Includes portions of the analysis area were Auwahi Wind project components are proposed; mitigation sites were not mapped.

The wind farm site is characterized by a combination of dry, rocky pastureland and scrub vegetation on rugged lava flows. This area, heavily grazed by cattle and feral ungulates, is generally dominated by non-native shrubs and other low-growing woody plants, though pockets of grassland or barren, rocky ground are also present. Dominant species include natal redtop (*Melinus repens*), glycine (*Neonotonia wightii*) and koa haole (*Leucaena leucocephala*). There are several well-developed groves of wiliwili, a few scattered native trees such as hao (*Rauvolfia sandwicensis*), and some large specimens of naio (*Myoporum sandwicense).*

The generator-tie line traverses several plant communities along its route, which travels inland from the wind farm site, toward the Southwest Rift ridgeline, crosses the ridgeline, and then descends to the Wailea substation. Vegetation communities include dry shrubland/scrub vegetation (from the wind farm site upslope to 4,000 ft [1,220 m] above sea level [ASL]) dominated by koa haole, glycine, lantana (*Lantana camara*), buffel grass (*Cenchrus ciliaris*), narrow-leaved plantain (*Plantago lanceolata*); grasslands and pastures (from 4,000 ft [1,220 m] to 1,000 ft [305 m] ASL on the windward slope) dominated by kikuyu grass (*Pennisetum clandestinum*), and Guinea grass (*Urochloa maxima*); and savanna (below 1,200 ft [365 m] on the windward slope) consisting of grassland with scattered trees and dominated by kikuyu grass, sweet vernal grass (*Anthoxanthum odoratum*), and kiawe trees. Areas crossed by the generator-tie line are also grazed by cattle and feral ungulates and are dominated by non-native species interspersed with patches of native vegetation. The savannah transitions to dryland forest as indicated by increased canopy cover below 800 ft (240 m) ASL but this vegetation community occurs outside the generator-tie line corridor. The most significant remaining dryland forest in the vicinity is located within the adjacent Kanaio NAR, located west (but outside) of the generator-tie line corridor.

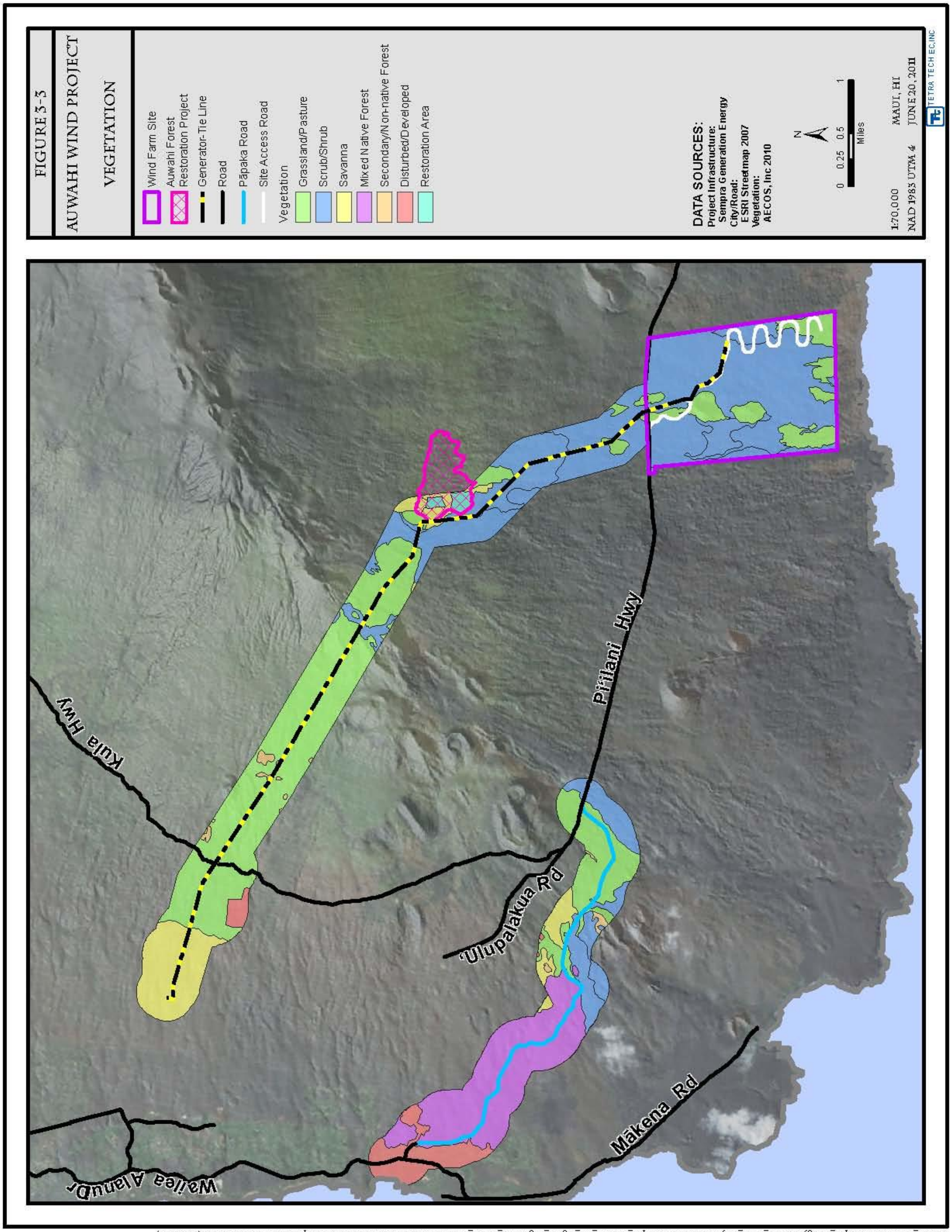


FIGURE 3-3
AUWAHI WIND PROJECT
VEGETATION
Wind Farm Site
Auwahi Forest Restoration Project
Generator-Tie Line
Road
Pāpaka Road
Site Access Road
Vegetation
Grassland/Pasture
Scrub/Shrub
Savanna
Mixed Native Forest
Secondary/Non-native Forest
Disturbed/Developed
Restoration Area
DATA SOURCES:
Project Infrastructure:
Sempra Generation Energy
City/Road:
ESRI Streetmap 2007
Vegetation:
AECOS, Inc 2010
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TETRA TECH EC, INC
Kula Hwy
Pi'ilani Hwy
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Mākena Rd
Wailea Alanui Dr
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The eastern half of Papaka Road, between Upcountry Piilani Highway and approximately 780 ft (238 m) ASL, is characterized by a combination of dry rocky pastureland and scrub vegetation. Species including koa haole, indigo (*Indigofera suffruticosa*), akia (*Wikstroemia oahuensis*), aalii, glycine, air plant (*Kalanchoe pinnata*), and uhaloa (*Waltheria indica*) are common to abundant. A relatively recent lava flow located along the west side of the Puu Naio cinder cone supports native species including natal redtop, aalii, common sword fern (*Nephrolepis multiflora*), and lantana (*Lantana camara*). Downslope, the vegetation changes gradually to a kiawe/buffel grass association mixed with groves of wiliwili.

Vegetation in the Auwahi Forest Restoration Project is dominated by the invasive kikuyu grass which has replaced the native shrub and fern understory. Forest microhabitats that normally would allow natural seedling generation at the site have been destroyed by invasive plants and animals and therefore native vegetation occurs primarily in the form of isolated rare plants and fragments of remnant native dryland forest. However, ongoing dryland forest restoration has facilitated the recovery of native shrubs and trees in portions of the site (USGS 2006). Section 2.2.3.2 describes in detail the ongoing restoration work in the Auwahi Forest Restoration Project.

The Kahikinui Forest Project, in the upper elevations where mitigation is proposed, consists of subalpine vegetation which becomes increasingly degraded with lower elevations into a matrix of non-native grasslands, stands of planted non-native trees and a large naturalized stand consisting primarily of black wattle (*Acacia mearnsii*) (LHWRP 2006). The Alpine Rockland subzone occurs above about 8,000 ft (2,438 m) on Haleakala and consists primarily of unvegetated volcanic substrates. Haleakala tetramolopium (*Tetramalopium humile*), Hawaii bentgrass (*Agrostis sandwicensis*), and pili uka (*Trisetum glomeratum*) appear to be the most abundant species in this zone and Kupaoa (*Dubautia menziesii*) becomes the dominant shrub at the highest elevations (LHWRP 2006). The Subalpine Shrubland subzone occurs between 6,000 and 8,000 ft (1,829 and 2,438 m). Alpine mirrorplant (pilo; *Coprosma montana*), mamane (*Sophora chrysophylla*), pukiawe (*Styphelia tameiameiae*), and ohelo ai (*Vaccinium reticulatum*) are the dominant shrubs within this subzone (LHWRP 2006). Vegetation in this mitigation site has been subject to browsing by non-native ungulates including goats and pigs.

The Waihou Mitigation Area consists of pastureland dominated by kikuyu grass. Tree species have been planted to varying levels within the four parcels. The Kaumaea Loko and Puu Makua parcels are almost entirely pastureland with a small component planted with native trees (5 and 10 percent of their acreage, respectively). The Cornwell Spring parcel consists of native koa (*Acacia koa*) forest (approximately 50 percent), non-native forest dominated by Pacific ash (*Fraxinus uhdei*; 20 percent), and pastureland. Finally, the Duck Ponds parcel is approximately 60 percent forested, dominated by Monterey pines (*Pinus radiata*), with the remaining acres in pastureland.

Special Status and Rare Plant Species – Special status species documented within the area surveyed in 2010 and 2011 are listed in Table 3.6-2 (David and Guinther 2011; Guinther and Montgomery 2011). It should be noted that some species documented during the 2007 surveys, which covered a broader area than the footprint of the Auwahi Wind project, were not documented in 2010 or 2011, including the endangered mahoe and the federal species of concern island nesoluma (*Nesoluma polynesicum*). These species still have the potential to occur within the vicinity of the Auwahi Wind project depending on conditions from year to year. Prior to construction, additional botanical surveys would be conducted to identify occurrences, if any, of special status plant species that may vary in presence from year to year.

Table 3.6-2. Occurrence of special status plant species within the analysis area.[1]

Common and Scientific Names	USFWS/ State Status[2/]	Habitat	Occurrence in Surveys[3/]
Maiapilo (*Capparis sandwichiana*)	SOC	Coral, basalt, or rocky soil along the coast or slightly inland.	Adjacent to construction access route (three plants within the road corridor) and the internal wind farm access road near WTG 5 (one plant).
Iliahi (*Santalum freycinetianum* var. *lanaiense*)	FE	Dry, moist and wet forests and shrublands; old lava flows.	One plant in the generator-tie line corridor (leeward slope, above 2,800 ft [850 m]).
Aiea (*Nothocestrum latifolium*)	C	Dry and moist forests; on dry leeward hills and old lava flows.	One plant near the met tower and one plant in the generator-tie line corridor. (leeward slope, above 2,800 ft [850 m])
Kooloaula (*Abutilon menziesii*)	FE	Dry forests	One plant adjacent to WTG 5.

[1]/Areas surveyed do not include the mitigation sites.

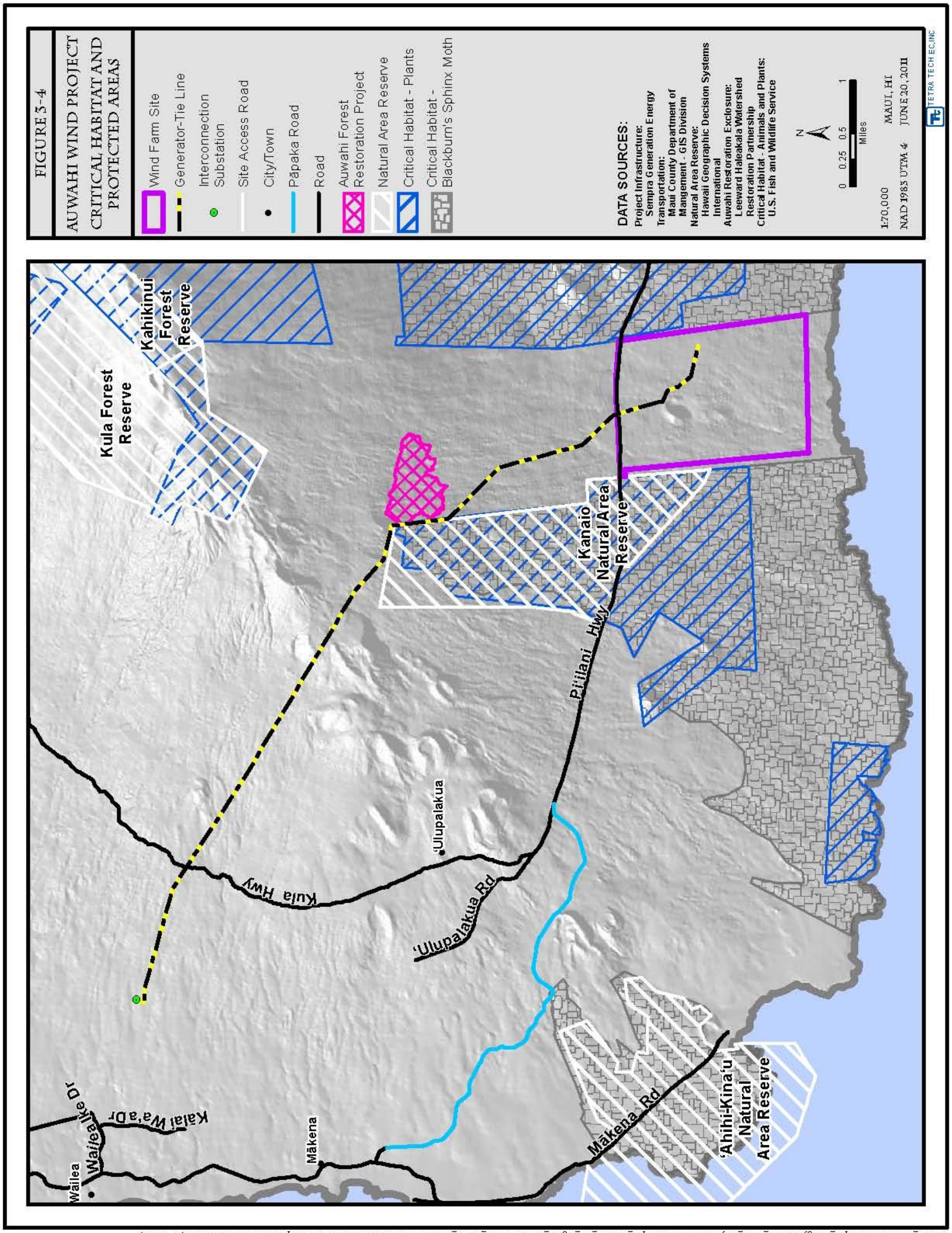
[2/] FE = listed endangered; SOC = State species of concern; C = candidate for listing.

3/ Based on 2010 and 2011 botanical surveys (David and Guinther 2011; Guinther and Montgomery 2011).

One federally endangered species, Kooloa ula or red ilima (*Abutilon menziesii*), was documented within the wind farm site (one plant), adjacent to the pad for WTG 5, but outside of any area of potential disturbance. One candidate for listing, aiea, was documented in the wind farm site near the met tower (one plant), within an area of permanent disturbance. One rare species, maiapilo (*Capparis sandwichiana*), was also documented. Four maiapilo plants were located adjacent to the internal wind farm access road near WTG 5, one of which occurs in an area of temporary disturbance.

Scattered remnants of wiliwili (isolated trees and some well-developed groves) also occur within this area. Although wiliwili is not a listed species, it is an endemic to Hawaii and is considered a keystone species of the native dry forest ecosystem, with less than 10 percent of its original distribution remaining (USGS 2006). Wiliwili is also important from a Hawaiian cultural/ethnobotanical perspective because its lightweight wood is used for constructing outriggers and fishfloats and its seeds are used for making leis and other traditional adornments (Bishop Museum 2011). However, the understory of the wiliwili groves in the project area is no longer intact and often dominated by non-native grasses.

One federal and state-listed endangered species, iliahi (*Santalum freycinetianum*), and one candidate for federal listing, aiea, were documented within the generator-tie line corridor. A single individual of iliahi occurs in an area of permanent disturbance and a single individual of aiea occurs in an area of temporary disturbance. Another candidate for federal listing, holei (*Ochrosia haleakalae*), was documented 490 ft (150 m) east of the generator-tie line centerline, but outside of any area of potential disturbance. These species are all endemic to the Hawaiian Islands. Critical habitat for 10 plant species has been designated east and west of generator-tie line corridor in Units 9 and 13, respectively, of an area referred to as "Maui H" (USFWS 2003). The generator-tie line corridor does not coincide with either unit but borders Maui H Unit 13, which includes the Kanaio NAR, for 1 mile (1.6 km) before it veers west (Figure 3-4). Native dryland forest associated species including individual wiliwili and ilima were also documented within the generator-tie line corridor.



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One rare species, maiapilo was documented in the vicinity of the construction access route (David and Guinther 2011). Three individual maiapilo occur within an area of temporary disturbance along Papapka Road; other plants of this species occur adjacent to the construction access road but outside of the areas of disturbance. A single occurrence of island nesoluma, another federal species of concern, was identified in the Hawaii Biodiversity and Mapping Database as being located several miles from the road. Although not within the analysis area, this suggests the species has the potential to occur in the area. Papaka Road passes through several areas of remnant wiliwili forest, though these trees are primarily outside the areas where road improvements would occur.

Various federally listed plant species have critical habitat in the Kahikinui Forest Project and surrounding area (DOFAW 2004). The Kahikinui Forest Project includes critical habitat for crane's bill (*Geranium arboretum*), kookoolau (*Bidens micrantha* ssp. *Kalealaha*), Hawaii silversword (*Argyroxiphium sandwicense* ssp. *Macroceph)*, and mahoe (*Alectryon micrococcus*). Likewise the Waihou Mitigation Area is adjacent to the Kula Forest Reserve where critical habitat for several listed plant species has been designated including Hawaii silversword, kookoolau*,* oha wai (*Clermontia lindseyana*), Asplenium-leaf diellia (*Diellia erecta*), and crane's bill (USFWS 2010). Therefore both mitigation sites have the potential for sensitive plant occurrence. The Auwahi Forest Restoration Project also occurs in an area with remnant dryland forest fragments which likely support some rare and sensitive plants. Species being planted there include iliahi, aiea, and potentially other federally listed plants.

3.7 WILDLIFE

The analysis area for impacts to wildlife includes the proposed wind farm site and substation, a 0.25-mile (0.4-km) buffer on either side of the proposed generator-tie line centerline and the Papaka Road centerline, as well as the mitigation sites. This area encompasses all potential effects to wildlife and habitats including habitat loss or alteration, noise disturbance, and direct mortality within the footprint of the Auwahi Wind project (area of disturbance associated with project structures or restoration activities) as well as areas extending beyond where wildlife could be exposed to disturbance. The analysis area provides habitat for a variety of birds, most of which are non-native, as well as for several non-native mammal species and numerous invertebrates. There are no wetlands or waterbodies within the analysis area and the layout does not include any areas where congregations of birds occur. Site-specific avian surveys indicate that the Auwahi Wind project is not located in a movement corridor for daily movements by water birds.

3.7.1 Non-listed Wildlife

During the avian and terrestrial mammalian surveys, 11 mammalian species and 27 avian species were observed (Table 3.7-1). An additional three avian species were observed incidentally during other surveys. All but three species documented are common and not native to the Hawaiian Islands. The native avian species observed include the Hawaiian short-eared owl and amakihi, which are endemic subspecies, and the Pacific golden plover, which is indigenous to Hawaii and a migrant that winters in coastal and upland areas of the main Hawaiian Islands.

The invertebrate survey results, which covered a much larger area than the Auwahi Wind project, indicated that the project site and surrounding area supports a variety of native terrestrial mollusks and native and adventive arthropod species, including the federally and state listed Blackburn's sphinx moth. The Blackburn's sphinx moth is a Covered Species in the HCP and therefore is further discussed in Section 3.7.4.4. Thirty-six of the 49 total invertebrate species documented are endemic or indigenous to the Hawaiian Islands such as the yellow-faced bee that was under review for listing (not listed - warranted but precluded) but not included as a Covered Species. Of the yellow-faced

Table 3.7-1. Bird and mammal species observed surveys for the Auwahi Wind project.

Species	Protected Status[1/]	Species	Protected Status[1/]
Birds			
African silverbill (*Lonchura cantans*)	None	Java sparrow (*Padda oryzivora*)	None
Hawaii amakihi (*Hemignathus virens*)[2/]	None	Mourning dove (*Zenaida macroura*)	MBTA
Barn owl (*Tyto alba*)	MBTA	Northern cardinal (*Cardinalis cardinalis*)	MBTA
Black francolin (*Francolinus francolinus*)	None	Northern mockingbird (*Mimus polyglottos*)	MBTA
California quail (*Callipepla californica*)	None	Nutmeg mannikin (*Lonchura punctulata*)	None
Cattle egret (*Bubulcus ibis*)	MBTA	Pacific golden plover (*Pluvialis fulva*)	MBTA, HSOC
Chukar (*Alectoris chukar*)	None	Red junglefowl (*Gallus gallus*)	None
Common myna (*Acridotheres tristis*)	None	Red-crested cardinal (*Paroaria coronata*)	None
Common peafowl (*Pavo cristatus*)	None	Ring-necked pheasant (*Phasianus colchicus*)	None
Gray francolin (*Francolinus pondicerianus*)	None	Short-eared owl (*Asio flammeus sandwichensis*)	MBTA, HSOC
House finch (*Carpodacus mexicanus*)	MBTA	Sooty tern (*Onychoprion fuscatus*)[3/]	MBTA
Japanese bush-warbler (*Cettia diphone*)	None	Sky lark (*Alauda arvensis*)	MBTA
Japanese quail (*Coturnix japonica*)	None	Spotted dove (*Streptopelia chinensis*)	None
Japanese white-eye (*Zosterops japonicus*)	None	Zebra dove (*Geopelia striata*)	None
Mammals			
Axis deer (*Axis axis*)	None	Domestic horse (*Equus c. caballus*)	None
Domestic cat, feral cat (*Felis catus*)	None	European house mouse (*Mus musculus domesticus*)	None
Domestic cattle (*Bos taurus*)	None	Feral pig, wild boar (*Sus s. scrofa*)	None
Domestic dog (*Canis f. familiaris*)	None	Roof rat (*Rattus r. rattus*)	None
Feral goat (*Capra h. hircus*)	None	Small Indian mongoose (*Herpestes a. auropunctatus*)	None

1/ MBTA= Migratory Bird Treaty Act; HSOC = Hawaiian Species of Concern
2/ Documented during the invertebrate surveys of the generator-tie line.
3/ Documented during the fall radar surveys (Hamer Environmental 2010a).

bee species that were considered for listing, five (*Hylaeus facilis, H. longiceps, H. anthracinus, H. assimulans,* and *H. hilaris*) occur on Maui and their current distribution is restricted to remnant patches of native coastal strand and lowland dry habitat (Magnacca 2005a,b,c,d,e; 2007). These species almost exclusively visit native plants to collect nectar and pollen, pollinating these plants in the process, and have been rarely observed visiting non-native plants. Thus they are dependent on intact native vegetation communities and they are absent from many of their historical locations, which have been developed or overtaken by invasive vegetation. Degradation and loss of habitat due to land management practices, fire, and other factors is considered the primary threat to these sepcies (USFWS 2010). Ilima, a host plant and a pollen source, for the bee species, has been documented adjacent to the construction access route (David and Guinther 2011). Only one species, *H. assimulans*, was documented in the wind farm site on ilima flowers during 2008 invertebrate surveys. Additional invertebrate surveys conducted in March-April 2011 documented Hyleaus bees on poppy, nehe, and ilima plants in the wind farm site, two of which were identified as *H. assimulans*. Pollen plants were also documented along the generator-tie line corridor and construction access route. A full list of invertebrate species observed during the surveys is provided in the HCP.

3.7.2 Hawaii State Species of Concern

Two Hawaii state species of concern that may occur within the vicinity of the Auwahi Wind project include the Hawaiian short-eared owl and Pacific golden plover (David and Guinther 2011, Appendix B; Hamer Environmental 2010a). These species are addressed below.

3.7.2.1 Hawaiian Short-eared Owl

The Hawaiian short-eared owl is considered a species of concern by the USFWS and is listed as endangered by the state of Hawaii on the island of Oahu, and also afforded protection under the MBTA (Mitchell et al. 2005). The Hawaiian short-eared owl (pueo) is found on all the main Hawaiian Islands from sea level to 2,450 m (8,000 ft). This diurnal species nests on the ground but little is known about the breeding biology of the short-eared owl. Nests of this species have been found throughout the year. The current population status is unknown although Hawaiian short-eared owls are thought to be declining. This owl species occupies a variety of habitats, including dry forests and rain forests, but is observed most often in grasslands. The Hawaiian short-eared owl was observed very infrequently flying within the wind farm site during point count surveys (early June 2007) and radar surveys (David and Guinther 2011; Hamer Environmental 2010a).

Hawaiian short-eared owls have the potential to collide with WTGs and other project structures. As of August 2010, there have been three Hawaiian short-eared owl fatalities documented at the Kaheawa I wind farm, two due to turbine collisions and one due to a vehicle collision (Hufana, pers. comm., 2010).

3.7.2.2 Pacific Golden Plover

The Pacific golden plover is a migratory shorebird and a state species of concern in Hawaii. The winter range of this species occurs from the South Pacific and Japan through southern Asia and the Middle East to northeast Africa. This species over-winters in Hawaii from breeding grounds in Alaska and is found in short-grass prairie, pastures, mudflats, sandy beaches, and flooded fields. The Pacific golden plover was observed flying over the wind farm site during the fall 2006 radar surveys (Hamer Environmental 2010).

The Pacific golden plover also has the potential to collide with WTGs and other project structures. Pacific golden plovers have been killed by collisions with tall structures (e.g., radio towers) and aircraft strikes at the Kahului airport on Maui occur occasionally in the fall, apparently as juvenile birds attempt to establish foraging territories on airport ground (Mitchell et al. 2005). As of August 2010, there have been no documented Pacific golden plover fatalities at the operating Kaheawa I wind farm on Maui (Hufana, pers. comm., 2010).

3.7.3 MBTA-protected Species

Ten avian species protected by the MBTA (75 FR 9282-9314) were documented during avian surveys in the wind farm site (Table 3.7-1). Two of the MBTA species are Hawaii state species of concern (Section 3.7.2). Some of the MBTA species listed above were intentionally introduced to the Hawaiian Islands from the continental United States and, therefore, are considered non-native. Of these non-native species, some (e.g., cattle egret, mourning dove, and barn owl) are quite common on Maui and in Hawaii. These species may use the analysis area for nesting or foraging and are associated with a variety of habitats.

3.7.4 ESA-Species

Five state and federally listed wildlife species are known to occur, or could potentially occur, near the Auwahi Wind project, including the Hawaiian petrel, Newell's shearwater, Hawaiian hoary bat, Blackburn's sphinx moth, and Hawaiian goose.

The Newell's shearwater is unlikely to occur in the vicinity of the Auwahi Wind project. Although Newell's shearwaters have been observed on Maui, there are no confirmed breeding colony locations (although they are suspected to nest on the island). In West Maui, recent radar and audio-visual surveys suggest that Newell's shearwaters may be potentially nesting in the upper portions of the Kahakuloa Valley but is not yet confirmed (KWP 2010). Newell's shearwaters were not confirmed during radar surveys conducted in the wind farm site and are not expected to fly over the project area (Duvall, pers. comm., 2010). Hence, incidental take of this species is not expected to occur in association with the Auwahi Wind project. As a result, the Newell's shearwater is not considered as a Covered Species under the HCP, and is not discussed further here.

The following subsections describe the status (state and federal statuses for these species are the same), biology, current threats, and potential occurrence of ESA-listed species and species under consideration for listing within1 the analysis area. These species are collectively referred to as the Covered Species.

3.7.4.1 Hawaiian Hoary Bat—Endangered

Distribution, Population Estimates and Ecology

The Hawaiian hoary bat is the only fully terrestrial native mammal in the Hawaiian Islands. The largest populations and only known breeding populations are thought to occur on Kauai and Hawaii (Duvall and Glassman-Duvall 1991). Duvall and Glassmann-Duvall (1991) suggested that at least one resident population of the Hawaiian hoary bat, a potentially breeding population, exists on Maui. Relatively little research has been conducted on this endemic Hawaiian bat and data regarding its habitat and population status are very limited. Population estimates for this species have ranged from hundreds to a few thousand; however, these estimates are based on limited and incomplete data due to the difficulty in estimating populations of patchily distributed bats (USFWS 2007).

The Hawaiian hoary bat breeds between September and December with implantation delayed until spring, after they emerge from winter torpor (USFWS 1998). Gestation and rearing of young takes place between April and August; the birth of typically two young usually occurs between April and June. Lactating females have been documented from June to August and post-lactating females have been documented from September to December (Menard 2001). Until weaning, young of the year are completely dependent on the female for survival.

The Hawaiian hoary bat is found in both wet and dry areas from sea level to 3,962 m (13,000 ft) elevation, with most observations occurring up to 2,286 m (7,500 ft); it uses a variety of habitats that include open pastures and more heavily forested areas in both native and non-native habitats (DLNR 2005). Typically, this species feeds over streams, bays, or along the seacoast, over lava flows, in open pastures, or at forests edges. The Hawaiian hoary bat is an insectivore, and prey items include a variety of native and non-native night-flying insects, including moths, beetles, crickets, mosquitoes, and termites (Whitaker and Tomich 1983). Hawaiian bats are known to roost solitarily in tree foliage and have only rarely been seen exiting lava tubes, leaving cracks in rock walls, or hanging from man-made structures. Foliage roosting for this species has been documented in hala

(*Pandanus tectorus*), coconut palms (*Cocos nucifera*), kukui (*Aleurites moluccana*), pukiawe (*Styphelia tameiameiae*), Java plum (*Syzygium cumini*), kiawe, avocado (*Persea americana*), shower trees (*Cassie javanica*), ohia trees (*Meterosideros polymorpha*), and fern clumps; they are suspected to roost in Eucalyptus (*Eucalyptus* spp.) and Sugi pine (*Cyrptomeria japonica*) stands (USFWS 1998; DLNR 2005). While the Hawaiian hoary bat may migrate inter-island and within topographical gradients on the islands, long distance migration like that of the North American hoary bat is unknown (USFWS 1998). Seasonal and altitudinal differences in bat activity have been suggested (Menard 2001) but the timing and extent of this variation are unknown.

Threats

The main threats to the Hawaiian hoary bat may include reduction in tree cover, pesticide use, prey availability due to the introduction of non-native insects, and predation. It is unknown what effect these threats have on the population. Observation and specimen records suggest that these bats are now absent from historically occupied ranges. The magnitude of any population decline is unknown. The hoary bat in North and South America is one of the bat species most frequently killed by WTGs, primarily during fall migration (Kunz et al. 2007). To date, two Hawaiian hoary bats have been killed at the existing Kaheawa Wind Power facility during nearly 5 years of operation (Hufana, pers. comm., 2010).

Occurrence on Maui and the Analysis Area

Limited available information on habitat for this species indicates a preference for forested areas for roosting and foraging, which suggests that the occurrence of this species in the analysis area is infrequent due to the lack of suitable forested habitat. Historically, Hawaiian hoary bats have been observed on Ulupalakua Ranch in low numbers (David and Guinther 2011). More recently, biologists recorded a single Hawaiian hoary bat audio detection and observed bat-like targets on the radar screen during the May 2010 radar surveys (Hamer Environmental 2010b). Two Anabat detectors were erected on the temporary met tower located within the turbine string in July 2010 and monitoring is ongoing and will continue through July 2011. To-date, very low levels of bat activity have been recorded. Results of acoustic monitoring surveys within the wind farm site indicate that over a one year period of monitoring (July 2010 through August 2011), a total of 78 bat passes were recorded resulting in 0.12 bat passes/detector night, with a maximum of 5 calls recorded in one night. These results are consistent with the lack of forest within the Auwahi Wind project to provide suitable habitat for roosting and breeding, suggesting that the occurrence of this species in the project area is likely infrequent and associated with foraging. The level of bat activity is low in comparison to similar studies on both the mainland and Hawaii (Bonaccorso pers. comm. 2008; Kepler and Scott 1990; Menard 2001), as expected due to the lack of suitable foraging and roosting habitat in the project area.

Hawaiian hoary bats are also known to occur both in the lower elevations Kahikinui Forest Project (but outside the mitigation site) and the Waihou Mitigation Area. These areas support dryland forest habitat that has the potential to provide roosting and breeding habitat for this species.

3.7.4.2 Hawaiian Petrel—Endangered

Distribution, Population Estimates, and Ecology

The endemic uau or Hawaiian petrel is one of the larger species in the *Pterodroma* group. This species formerly nested in large numbers on all of the main islands in the Hawaiian chain except Niihau. Currently, Hawaiian petrels nest at high elevations on Maui, primarily in Haleakala National Park, and in smaller colonies on Kauai, Hawaii, Molokai, and Lanai. Population estimates for the species are mainly based on at-sea numbers; the total population of Hawaiian petrels is estimated to be 20,000, with an estimated 4,500 to 5,000 nesting pairs on Kauai and Maui (Mitchell et al. 2005). The more recently rediscovered colony on Lanai is thought to number over 1,000 birds (Tetra Tech 2008a).

During the non-breeding season, Hawaiian petrels are found far offshore, primarily in waters of the eastern tropical Pacific. Nesting colonies are typically located on steep slopes at high elevation, xeric habitats or wet, dense forests. Nests may be in burrows, crevices, or cracks in lava tubes in both sparsely vegetated areas and areas with dense vegetation (e.g., uluhe fern [*Dicranopteris linearis*]). In the nesting colony in the south rim of the Haleakala Crater, nests occur in more densely vegetated areas of shrub cover (Simons and Hodges 1998).

Adult Hawaiian petrels are long lived (up to 30 years) and return to their colonies and to the same burrows each year between March and April. One egg is laid by the female, which is incubated alternately by both parents, for approximately 55 days. The egg is not replaced if it is lost to predation. When eggs hatch in July or August, both adults make nocturnal flights out to sea to bring food back to the nestlings. Hawaiian petrels feed their young mostly at night and most movements take place during crepuscular periods (Cooper and Day 2003). On Kauai, Hawaiian petrels traveled primarily inland in the evenings, seaward in the morning, and in both directions during the night (Day and Cooper 1995). In October and November, the fledged young depart for the open ocean. Petrels exhibit strong philopatry, returning to their natal colony to breed and returning to the same nesting site over many years (Cruz and Cruz 1990; Podolsky and Kress 1992). Adults do not breed until age 6 and may not breed every year, although they all return to the colony to socialize (USFWS 1983; Mitchell et al. 2005). During their pre-breeding period, they may “wander” or “prospect,” visiting a number of potential breeding sites (established colonies, former breeding sites and uncolonized sites); factors such as availability of mates, food abundance, the presence of predators and conspecifics could all be important for deciding where to breed (Podolsky and Kress 1992).

Threats

A variety of threats have been documented for the Hawaiian petrel, but the greatest limiting factors include habitat degradation at breeding colonies and disturbance or predation by introduced animals during the breeding season (USFWS 1983; Carlile et al. 2003; Mitchell et al. 2005). Introduced ungulates, including feral goats, pigs, axis deer, and cattle, browse on native vegetation and groundcover within petrel colonies and trample and collapse burrows causing nest abandonment. The soil disturbance caused by ungulates also facilitates the introduction and spread of invasive plants, further reducing habitat suitability for this species (Reeser and Harry 2005). Ungulates also create trails in the colony that increase access to active burrows by predators. Annual monitoring of nests at Haleakala National Park has shown that predation by cats and mongooses causes more than 60 percent of all egg and chick mortality in some years (Simons 1998 as cited in Carlile et al. 2003). Rats also prey upon Hawaiian petrels but to a lesser extent. Even an individual predator, such as a small Indian mongoose can be extremely destructive with the potential to decimate an entire population of colony-nesting seabirds (Hodges and Nagata 2001). In addition, fledgling petrels sometimes collide with power lines, fences, and other structures (Hodges 1994) or become disoriented by lights (Telfer et al. 1987). Adults apparently are not attracted to lights to the same degree as fledglings but adults may collide with structures. Since the beginning of operations in 2006, three Hawaiian petrel WTG-related fatalities have been recorded at Kaheawa I Wind Project (Greenlee, pers. comm, 2011).

Occurrence on Maui and in the Analysis Area

Haleakala National Park in East Maui supports the largest known nesting colony of Hawaiian petrels (USFWS 2005b; Hodges and Nagata 2001) with approximately 1,000 known burrows. This colony is approximately 5 mi (8 km) northeast of the Auwahi Wind project. The nests are within the crater of the dormant shield volcano; the highest concentration occurs on the western rim between 7,874 and 10,023 ft (2,400 and 3,055 m) in elevation. A small subcolony has been located along the south rim of the crater (Simons and Hodges 1998). Field studies and research conducted in support of the Kaheawa I HCP confirmed the presence of a small nesting colony in West Maui in the lower portion of Kahakuloa Valley (Makamakaole Colony), later corroborated by DLNR/DOFAW biologists, and documented evidence of a potential nesting colony in the West Maui Mountains in the upper portions of Kahakuloa and Honokohau (KWP 2010). These are located approximately 25 miles (40 km) from the Auwahi wind farm site.

Hawaiian petrels have been documented flying over the wind farm site during radar surveys conducted in the wind farm site in fall 2006 and spring 2010. Radar surveys documented mean passage rates of 12.01 (fall) and 7.31 (spring) petrel targets per hour (Hamer 2010a). The spring passage rates are expected to be higher than the fall rates because the non-breeders are still on-island during the spring. The relatively higher fall 2006 data may include an unknown number of sooty terns as they were detected by outside observers but could not be distinguished from targets on the radar screen. Additionally, radar surveys have been conducted by other entities near where the proposed generator-tie line crosses a ridge next to the communication towers owned by Island Airwaves. The towers are located on the Ulupalakua Ranch within a 3-acre (1.2-hectare) parcel at roughly 4,450-ft (1,356-meter) elevation. Radar surveys were conducted over five nights in 2007. Petrel passage rates over this area averaged 2.3 petrel targets per hour (Gall and Day 2007 as cited in USFWS 2008).

Petrels are known to occur at the higher elevations of the Kahikinui Forest Project, approximately 5 miles (8 km) from the Auwahi Wind project. Active burrows were documented during preliminary surveys conducted in April and June/July 2011.

3.7.4.3 Hawaiian Goose—Endangered

Distribution, Population Estimates, and Ecology

The Hawaiian goose is the only existing endemic goose in the Hawaiian Archipelago and was reintroduced on Maui as part of its recovery plan. Fossil evidence suggests that historically the Hawaiian goose occurred on all of the main Hawaiian Islands. However, the current population occurs from just above sea level to approximately 8,858 ft (2,700 m) on the islands of Kauai, Maui, Hawaii, and Molokai, a distribution influenced largely by the locations of release sites of captive-bred birds (Banko et al. 1999). The statewide population consists of more than 1,300 birds with approximately 450 on Maui (250 to 300 in Haleakala National Park). Populations are increasing on Kauai and Molokai, while the Hawaii and Maui populations are stable (HNP 2009).

Hawaiian geese nest between October and March, during the wet winter season. Clutch size is typically three to five eggs. Hawaiian geese nest on sparsely vegetated lava flows or on the vegetated edges of kipukas (islands of vegetation around which lava once flowed and which are now characterized by vegetation older than the surrounding areas). Historically, Hawaiian geese bred in lowland habitats; however, these areas have been destroyed by development or have become inundated with predators and now nesting occurs at higher elevations (Banko et al. 1999). Typically, Hawaiian geese do not re-nest in the same season if the first attempt fails. At approximately 10 to 12 weeks, the young are able to fly. During the nonbreeding season, Hawaiian geese forage in pastures and grassland habitats. Unlike other species of goose, Hawaiian geese are non-migratory, making only island-wide movements of up to 6 miles (10 km), and do not require standing water.

Threats

The 2004 draft recovery plan for the Hawaiian goose (USFWS 2004) lists predation by non-native mammals as the greatest factor limiting Hawaiian goose populations. In Haleakala National Park, rats and mongooses were observed to be the main predators (Baker and Baker 1995). Other threats to the species include exposure in high elevation habitats, insufficient nutritional resources for breeding females and for goslings, lack of lowland habitat, human-caused disturbance and mortality (e.g., road mortality, disturbance by hikers), behavioral problems related to captive propagation, and inbreeding depression as primary threats to the species.

Occurrence on Maui and in the Analysis Area

On Maui, the Hawaiian goose is found primarily within the boundaries of Haleakala National Park at elevations between 6,300 and 7,700 ft (1,920 and 2,347 m) ASL (Banko et al. 1999). They also occur in the West Maui Mountains, and around the towns of Lahaina, and Wailuku (USFWS 2004). During a radar survey conducted on May 26, 2010, seven overlapping, Hawaiian goose vocalizations were heard adjacent to the wind farm site. However, Hawaiian geese have not been detected or heard vocalizing during any other project surveys or incidentally. Also Hawaiian geese have not been observed onsite. Because the Hawaiian goose detection appears to have been a single event, and because suitable habitat does not exist in the analysis area, Auwahi Wind anticipates there is only a small chance that Hawaiian geese could fly through the wind farm site or across the generator-tie line corridor.

3.7.4.4 Blackburn's Sphinx Moth—Endangered

Distribution, Population Estimates, and Ecology

The Blackburn's sphinx moth one of Hawaii's largest native insects and a federally listed insect in Hawaii. This species was once known to occur on all seven of the Hawaiian Islands and now is found only on Hawaii, Maui, and Kahoolawe. This species was believed extinct until 1984, when a single population was rediscovered on East Maui (USFWS 2003). Additional populations on two other islands were subsequently rediscovered. Blackburn's sphinx moth population numbers are known to be small based upon past sampling results, however, no accurate estimate of population sizes have been made due to the rarity and wide-ranging behavior of the adult moths (Black 2005). It is difficult to determine densities of this species given the high variability in populations between years and seasons in association with climatic and environmental conditions that affect the quality and quantity of available habitat.

Adult moths can be found year-round but are most active from January through April and from September through November. Larvae take 65 days to develop to adulthood, but pupae may remain in torpor in the soil for up to a year. Larvae sightings have only been documented between the months of October and May (USFWS 2005a). The lifespan for this moth is unknown but presumed to be short.

This species is most commonly found in dry to mesic forests throughout its current range between sea level and 5,000 ft (1,525 m), and is known to occur in this habitat on Maui. Larvae of the Blackburn's sphinx moth feed on plants in the nightshade family (*Solanaceae*). The native host plants are trees within the genus *Nothocestrum* (aiea; *N. latifolium* and *N. breviflorum*; Riotte 1986), on which the larvae consume leaves, stems, flowers, and buds. However, many of the host plants recorded for this species are not native to the Hawaiian Islands, including *Nicotiana tabacum* (commercial tobacco), *Nicotiana glauca* (tree tobacco), *Solanum melongena* (eggplant), *Lycopersicon sculentum* (tomato), and possibly *Datura stramonium* (Jimson weed; Riotte 1986). Although Blackburn's sphinx moth larvae feed on the non-native tree tobacco (*Nicotiana glauca*), this plant is not considered a necessary biological requirement for this species given the ephemeral nature of this plant species and intolerance to drought (USFWS 2005a). Three plant species—maiapilo (*Capparis sandwichiana*), iliee (*Plumbago zeylanica*), and koali awa (*Ipomea indica*; native morning glory)—are thought to be food plants of adult moths.

Threats

The primary threats to the moth are predation by ants and parasitic wasps that prey on the eggs and larvae, and the continued decline of its native larval host plants (USFWS 2005a). The continued decline of the moth's native larval host plants are partly a result of feral ungulates, wildfire, introduced plants, human development, and ranching. Other threats to the species include predation by ants and several species of parasitic wasps and flies. Blackburn's sphinx moth is also susceptible to over-collection for personal collections or for trade. No known populations occur entirely within a protected area and the species is endangered throughout its range.

Occurrence on Maui and in the Analysis Area

Of the seven islands, this moth was historically most common on Maui, where the largest and most persistent population of this species currently occurs. The largest remaining grove of aiea trees in Hawaii is located on Maui in the Kanaio NAR, adjacent to the generator-tie line (Mitchell et al. 2005). The USFWS designated critical habitat for this species in the vicinity of the project, in critical habitat unit 9. Unit 9 contains what is likely the largest existing moth population or meta-population in its range. This unit contains native (aiea) and introduced larval host plants as well as numerous nectar-supplying plants for adult moths. Areas within this unit may serve as a source area for local populations and habitat for dispersing adult moths. Although the Auwahi parcel of Ulupalakua Ranch was originally considered for inclusion in the critical habitat unit, ultimately the Ulupalakua Ranch land was removed from the critical habitat unit because "the benefits provided by the landowners' voluntary conservation activities within and adjacent to these units outweigh the benefits provided by a designation of critical habitat" (USFWS 2003).

The species' non-native host plant, tree tobacco, has been observed in the generator-tie line corridor and adjacent to the construction access road during the invertebrate and botanical resources surveys conducted in 2007, 2010, and 2011. In 2010 and 2011, aiea plants were documented within the wind farm site and along the generator-tie line corridor. The native host plant also occurs within the adjacent Kanaio Reserve. Several adult nectar plants (maiapilo) were also documented along the construction access route. The Auwahi Forest Restoration Project also supports host plant and food plants for the Blackburn's sphinx moth.

Three adult male Blackburn's sphinx moths and one larva were observed at survey stations within the vicinity of the wind farm site and along the construction access road during 2007 invertebrate surveys (Montgomery 2008). The single larva was observed on one of the tree tobacco plants. In March-April 2011, an additional survey for the Blackburn's sphinx moth was conducted to capture wet season conditions. This survey, conducted approximately one year prior to the initiation of construction, involved assessing host plants for the presence of Blackburn's sphinx moth eggs, larvae, or signs indicating the possibility of pupating larvae (e.g., chewed stems or other browsing) and the mapping of adult nectar plants for the moth. In 2011, seven larvae and two eggs were found on tree tobacco plants along the construction access route; three additional tree tobacco showed possible evidence of larvae feeding.

3.8 LAND USE

Comprehensive plans, policies, and zoning regulations determine the type and extent of land uses allowable in specific areas and often protect environmentally sensitive land uses (Section 1.3). For purposes of the land use evaluation, the analysis area for assessing impacts to land use includes the Auwahi Wind project and adjacent parcels.

Existing Land Use – The majority of lands within the analysis area are on Ulupalakua Ranch which extends from the southern slopes of Haleakala to the ocean. The area has been primarily used for commercial cattle ranching and agricultural activities since about 1900. In addition to the Ulupalakua Ranch the land uses in the analysis area include:

- Vacant lands owned by the state of Hawaii;
- The Kanaio NAR managed by DOFAW;
- Upcountry Piilani and Kula highways;
- DHHL lands which support two homesteads;
- The Hoapili Trail which runs along the coastline;
- The Auwahi Forest Restoration Project managed by the LHWRP; and
- Rural residential land along Papaka Road including the town of Makena at its west end.

A total of 28 parcels are crossed by the Auwahi Wind project, of which 14 are owned by Ulupalakua Ranch, nine are owned by the state (of which 3 are leased by the Ulupalakua Ranch and 2 are co-owned with the County of Maui), one is jointly owned by Ulupalakua Ranch and another private party; 3 parcels are owned by the County of Maui; and 1 parcel is owned entirely by ATC Makena Holdings, LLC. Mitigation sites occur on parcels owned by Ulupalakua Ranch (Waihou) and DHHL (Kahikinui). The Auwahi Forest Restoration Project and Waihou Mitigation Area are located on land owned by Ulupalakua Ranch. The Kahikinui Forest Project is located on a parcel owned by DHHL.

In November 2009, the owners of Ulupalakua Ranch decided to preserve in perpetuity two-thirds of their 18,000 upcountry acres as agricultural lands. They did so formally with a donation easement to the Maui Coastal Land Trust). Ranch operations will not change, although the conservation easement donation—the largest of its kind in Hawaii history—will preclude future generations from selling the Ulupalakua land to developers. Wind generation was included as an allowable land use and activity under the conservation easement.

Policies and Land Use Plans – Applicable federal, state, and local regulations are discussed in Section 1.3.

3.9 TRANSPORTATION AND TRAFFIC

The analysis area for transportation and traffic is defined as the Auwahi Wind project, which includes the wind farm site, the generator-tie line corridor, and the construction access route (Papaka Road) as defined in Chapter 2, as well as the surrounding areas that could affect or be affected by the project, and the routes of travel to and from the project site and mitigation areas.

State, county, and privately owned highways and roadways as described in Section 2.2.2.3 comprise the proposed construction access route from Kahului Harbor to the wind farm site. These roads range from paved multi-lane highways to privately owned dirt pastoral roads. Construction traffic would be divided between two routes. Route A goes from Kahului to the Mokulele Highway, through Kihei, Wailea, and Makena, to Papaka Road, and then along Upcountry Piilani Highway to the wind farm site. This will be used for moving superloads (WTG components) and other heavy transport vehicles. Transporting WTG components to the wind farm site would require temporary roadway modifications and therefore, Route A is addressed in more detail throughout this section. Route B accesses the wind farm site via Haleakala Highway and Kula Highway. Several portions of Kula Highway, between Pukalani and Ulupalakua Ranch, have turn radii and slopes that are not adequate for the size of transport truck required to haul the WTG components. In addition, weight limits on some bridges are too low to accommodate the superloads; therefore, Route B would be used for project construction traffic from worker vehicles, dump trucks, and typical semi-trucks.

Route A of the proposed construction access route has been divided into nine distinct segments listed in Table 3.9-1. HDOT traffic count data collected at locations along the affected roadways indicate typical peak hour volumes of 400 to 2,300 vehicles per hour, with the exception of the Piilani Highway segment, measured between Keoke Park and Keawa Place, where only 6 to 22 vehicles were counted during peak hours. These data are included in Appendix G of the Final EIS for the project (Tetra Tech 2011).

Table 3.9-1. Construction access route from Kahului Harbor to the wind farm site (Route A).

Segment Number	Route	Ownership/ Jurisdiction	Approximate Distance
A0	Leave Kahului Harbor on Ala Luina Street.	HDOT	0.0 mile (0.0 km)
A1	Ala Luina Street/Hobron Avenue	County of Maui DPW	0.4 mile (0.6 km)
A2	Kaahumanu Avenue	HDOT	0.4mile (0.6 km)
A3	Puunene Avenue/Mokulele Highway (State Highway 311)	HDOT	7.3 miles (11.7 km)
A4	Piilani Highway (State Highway 31)	HDOT	7.2 miles (11.6 km)
A5	Wailea Ike Drive	County of Maui DPW	0.6 mile (1 km)
A6	Wailea Alanui Drive / Makena Alanui Drive/Makena Golf Road	County of Maui DPW	2.8 miles (4.5 km)
A7	Papaka Road (series of privately owned pastoral roads)	Private	4.7 miles (7.6 km)
A8	Upcountry Piilani Highway (east of Papaka Road entrance)	HDOT / County of Maui DPW	4.0 miles (6.4 km)
	Total Distance		27.4 miles (44.0 km)

DPW = Department of Public Works

HDOT = Hawaii State Department of Transportation

Access to the Auwahi Forest Restoration Project and Waihou Mitigation Area would be via existing Ulupalakua Ranch Roads. Access to the Kahikinui Forest Project would be via existing DHH, NPS, or ATST roads, with local access likely requiring helicopter transport.

3.10 VISUAL RESOURCES

Visual or scenic resources are the natural and built features of the landscape that contribute to the public's experience and appreciation of the environment. The analysis area for visual resources includes the Auwahi Wind project's zone of visual influence defined by the area within which

Auwahi Wind project and mitigation components could be visible from sensitive viewpoints (see below for additional discussion).

The visual setting of the analysis area consists of agricultural landscapes, vegetated conservation areas, and minimal urban and rural development (County of Maui 2010c). The western coast of Maui from Maalea to Makena is known as South Maui, with development along this area generally in a linear pattern between the shoreline and Upcountry Piilani Highway to form a continuous urban corridor that hosts Maui's tourist industry supported by the area's abundant ocean access points (County of Maui 2010b).

The area surrounding the Auwahi Wind project has few developed and residential areas that would be sensitive viewer locations. The only structures currently on the wind farm site are water tanks used for the ranching operation. There are fewer than 10 residences scattered in the vicinity of the site, with only 2 homes within a mile of the site. The Ulupalakua Ranch headquarters, general store, and winery are approximately 4 miles (6.4 km) west of the wind farm site. Aside from the scattered homesteads and the ranch, there are no residential or commercial developments in the vicinity. The Hoapili Trail, an ancient fishing trail currently used as a hiking trail, runs along the coast directly south of the proposed wind farm site.

The generator-tie line would pass through Ulupalakua Ranch pastureland, crossing both Upcountry Piilani Highway and Kula Highway. The route would pass immediately west of the Auwahi Forest Restoration Project site and east of the Kanaio NAR that is open to the public for hiking. The generator-tie line route would then extend west down the mountains that form the backdrop to the resort towns Wailea and Makena, which are considered important tourist destinations. The primary sensitive viewer groups with visibility of the WTGs and generator-tie line would be travelers on Upcountry Piilani Highway. Upcountry Piilani Highway is a proposed designated scenic corridor of exceptional value in the Draft Maui Island Plan (County of Maui 2010b).

The visual setting of the mitigation sites is natural. The area surrounding the Auwahi Forest Project and Waihou Mitigation Area is agricultural. The landscape of leeward Haleakala where the Kahikinui Forest Project mitigation site is located ranges from bare and rugged to forested (DOFAW 2004). Scenic value has been reduced in some areas due to the degradation of the native forest ecosystem.

3.11 AIR QUALITY

Under the authority of the Clean Air Act (CAA), the EPA has established nationwide air quality standards to protect public health and welfare. These federal standards, known as National Ambient Air Quality Standards (NAAQS), represent the maximum allowable atmospheric concentrations for six criteria pollutants: ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, lead, and particulate matter (inhalable particulate matter [PM_{10}] and fine particulate matter [$PM_{2.5}$]). The Clean Air Branch of the HDOH is responsible for implementing air pollution control in the state and has established Hawaii ambient air quality standards (HAAQS). The CAA general conformity rule requires that projects occurring in non-attainment (current air quality worse than NAAQS) and maintenance areas (previously violated NAAQS but now in attainment) be consistent with the applicable State Implementation Plan. Because Hawaii is, and always has been, in attainment for all pollutants, a general conformity analysis is not required for the Auwahi Wind project. The analysis area for air quality is East Maui.

In general, air quality in the state of Hawaii is some of the best in the nation, primarily because of consistent trade winds and limited emission sources. The HDOH and EPA maintain a network of air quality monitoring stations throughout the islands. Data collected from these monitoring stations indicate that criteria pollutant levels remain well below state and federal ambient air quality standards (HDOH 2010).

The closest air quality monitoring station to the Auwahi Wind project and mitigation sites is the Kihei Station, located in the Hale Piilani subdivision of upper Kihei, approximately 12 miles (19 km) northwest of the wind farm site. The areas surrounding this station are predominantly residential and agricultural land (primarily sugar cane). The most recent data collected for particles of 10 micrometers or less in diameter (PM_{10}) are from 2008. In 2009, the only measurements collected were for particles of 2.5 micrometers or less in diameter ($PM_{2.5}$) (HDOH 2009, 2010). The 24-hour PM_{10} readings in 2008 ranged between 9 and 78 micrograms per cubic meter ($\mu g/m^3$). The 24-hour $PM_{2.5}$ readings in 2009 ranged between 0.4 and 25.5 $\mu g/m^3$. The annual averages of PM_{10} and $PM_{2.5}$ reported at the Kihei Station for 2008 and 2009 were 20 $\mu g/m^3$ and 5 $\mu g/m^3$, respectively. These measurements are all below the federal and state standards (HDOH 2009, 2010).

The existing air quality in this part of Maui is considered to be relatively good because of the low levels of development and automobile emissions and exposure to consistently strong winds, which help to disperse any accumulation of emissions. Because the Auwahi Wind project and mitigation sites are in an undeveloped area, the only sources of pollutant air emissions within or directly adjacent to the site are associated with fuel combustion emissions from vehicles on Piilani Highway or ranching vehicles on the Ulupalakua Ranch. The analysis area is currently in attainment of all criteria pollutants established by the CAA and the HAAQS.

3.12 NOISE

The analysis area for noise includes all of the potentially noise sensitive receptors (NSRs) within an approximate 4-mile (6.4-km) radius of the wind farm site boundary. This area includes all receptors that may be potentially affected by project-generated noise, including the mitigation sites, but is conservative because receptors at this distance away would not likely be affected due to the significant separation distance from the project.

The Auwahi Wind project and mitigation sites would be located in a rural area with a low human population density. Existing ambient sound levels are expected to be low, although may be sporadically elevated in localized areas due to roadway noise or periods of human activity. Sources of sound on the ranch include passing vehicles on nearby roads, ranching activities (e.g., off-road vehicles), leaf or grass rustle during elevated wind conditions, wildlife and insect noise. Closer to the coastline, waves breaking on the seashore may also contribute to the overall existing soundscape. At the Waihou Mitigation Area and Auwahi Forest Restoration Project noise levels are low and consist primarily of sounds associated with ranching activity. At the Kahikinui Forest Project noise levels are low and primarily consist of existing sources (e.g., wind), though there is some noise generated by ongoing activity at adjacent the ATST site.

Potential noise impacts associated with construction and operation of the Auwahi Wind project were assessed in detail because this is where the majority of project-related noise would occur. The criteria used in the assessment are given in the State of Hawaii regulation HAR § 11-46, Community Noise Control. HAR § 11-46 provides for the prevention, control, and abatement of noise pollution in the state. HAR § 11-46 is not applicable to most moving sources, i.e., transportation and vehicular movements. Sound from the construction of the Auwahi Wind project and the occasional, major equipment overhauls during O&M would be regulated as construction activity.

The Hawaii noise limits from stationary sources are determined by three receiving zoning class districts and time periods and are enforceable at the facility property boundaries. For mixed zoning districts, the primary land use designation is used to determine the applicable zoning district class and maximum permissible sound level. For this acoustic assessment, agricultural portions of the surrounding properties were considered Class C receivers and the residences considered Class A receivers. This approach is considered a conservative regulatory assessment approach. Because wind energy generation projects may operate at any time during the day or night, the more stringent nighttime permissible sound level will become the controlling limit. The daytime and nighttime maximum permissible noise limits are expressed in A-weighted decibels according to zoning districts in Table 3.12-1. The Hawaii noise limits are assumed to be absolute and independent of the existing acoustic environment; therefore, no baseline sound survey is required to assess conformity.

Table 3.12-1. Hawaii maximum permissible sound levels by zoning district.

	Maximum Permissible Sound Level (dBA)[1]	
Receiving Zoning Class District	**Daytime**	**Nighttime**
Class A zoning districts include all areas equivalent to land zoned residential, conservation, preservation, public space, or similar type.	55	45
Class B zoning districts include all areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.	60	50
Class C zoning districts include all areas equivalent to lands zoned agriculture, county, industrial, or similar type.	70	70

1/ daytime: 7:00 a.m.to 10:00 pm; nighttime: 10:00 p.m. to 7:00 a.m.

dBA = A-weighted decibels

Source: HAR § 11-46

All of the NSRs near the Auwahi Wind project are within an area designated as Class C, a zoning district that includes all areas equivalent to lands zoned agriculture, county, industrial, or a similar type. The maximum permissible daytime and nighttime sound limit for Class C land use is 70 dBA. Therefore, an exceedance of the 70 dBA limit at any of the identified NSRs would be considered a significant impact.

3.13 CULTURAL RESOURCES

Cultural resources include archaeological sites, standing structures, objects, districts, traditional cultural properties, and other properties that illustrate important aspects of prehistory or history or have important and long-standing cultural associations with established communities or social groups. Cultural resources surveys were conducted in 2007, 2010, and 2011 pursuant to Section 106 of the NHPA, 1966 (as amended) and HAR § 13-276-4. The analysis area for archaeological and cultural resources consists of the Auwahi Wind project, including the wind farm site, the generator-tie line, construction access route, and interconnection substation, as well as the surrounding area including Auwahi Forest Restoration Project, Kahikinui Forest Project, and Waihou Mitigation Area.

Consultation History – Since 2006, on-going consultations between the project developer and the SHPD have been taking place and to date the following major documents have been submitted or are in preparation:

- A Final AIS was approved by SHPD on June 27, 2011;
- A SAIS, covering minor design modifications that further reduced cultural impacts, was approved by SHPD on October 17, 2011;

- An addendum to the SAIS was approved by SHPD on November 2, 2011;
- A Final Burial Treatment Plan, prepared in consultation with the Maui Lanai Burial Council (MLBC; see below), was approved December 1, 2011; and
- A Data Recovery Plan was approved by SHPD on November 3, 2011.

Presentations have also been given at MLBC meetings in July and September, 2010, and July, August, and October 2011, to discuss the findings of human remains and provide a general overview of the archaeology at Auwahi. Interested members of the public were present at these meetings and were invited to comment of the project and the findings. Consultation with the MLBC has included the development of a Burial Treatment Plan (BTP) for the Auwahi Wind project. A Final BTP was approved on December 1, 2011. As part of the BTP preparation, two separate public notices have been published in local Hawaiʻi newspapers to locate descendants of families from the area and persons knowledgeable about families from the area.

Two cultural impact assessments have been conducted for the Auwahi Wind project. The first was conducted by Solomon H. Kailihiwa, III of Pacific Legacy in 2008, when Shell Energy was the project proponent, and the second by Charles Kauluwehe Maxwell, Sr. of CKM Cultural Resources in 2010. These assessments involved interviews of members of the Maui community knowledgeable about the area of Auwahi.

The following summary relies heavily on information and data provided in detail in the Final AIS and associated SAIS (Pacific Legacy 2011a, b) and a Cultural Impact Assessment (CKM 2011) for the Auwahi Wind project.

Pre-historic and Historic Context – Within the wind farm site where the majority of archaeological survey work was conducted, the geological substrate is dominated by a few major lava flows of the Hana Volcanic Series. The Puu Hokukano cinder cone complex visually dominates the landscape, with its orange-red colored slopes. This cinder cone, the result of a late flank eruption, dates to between 30,000 and 50,000 years (30 and 50 kiloyears [kyr]) old. To the east of Puu Hokukano is a large massive flow of aphyric basalt, designated by Sherrod et al. (2007) as the "Chiefly Homes" flow; this dates to between 10 and 30 kyr. Farther east and straddling the Auwahi-Lualailua boundary is the Kīpapa-2 ankaramite flow, also between 10 and 30 kyr in age. Inland of Puu Hokukano and slightly to the east is the Auwahi ankaramite flow, much younger in age, only 3 to 5 kyr. This flow is covered with a high density of archaeological features. Immediately inland of the cinder cone is a deposition basin filled with in-washed sediments. This basin was evidently a major agricultural zone for the pre-Contact and early post-Contact Hawaiian population of Auwahi. Remnants of a formal agricultural field system were identified by the field team on the upper slopes of this basin. Finally, on the western side of Puu Hokukano is the large Kealakapu Basanite flow, between 10 and 30 kyr in age.

The coastal resources available to the pre-Contact and early historic inhabitants of Kahikinui were more restricted than in other parts of Maui. The coastline is dominated by sea cliffs ranging from a few ft to 98 to 164 ft (30 to 50 m) high, making access difficult except in scattered locations where there are small bays with cobble or gravel beaches. Not surprisingly, such bays are marked by concentrations of archaeological sites, indicating that Native Hawaiians focused their coastal activities around them. There is no fringing reef along the Kahikinui coastline. The Alenuihaha Channel between Maui and Hawaii is noted for its strong currents and rough seas, making fishing from small canoes hazardous. Surge-zone mollusks such as the prized opihi (*Cellana exarata*), small cowries or leho (*Cypraea caputserpentis*), nerites or pipipi (*Nerita picea*), drupes or pupu-awa (*Drupa ricinus*), and sea urchins (wana, *Centrechinus paucispinus*; hauke uke, *Podophora atrata*) can be gathered from the sea cliffs and lava rock benches, and octopus (hee) inhabit the shallower waters immediately offshore. Cowry-shell lures and "coffee-bean" type sinkers of the luhee fishing gear have been commonly found on the surface of Kahikinui archaeological sites.

Archaeological Survey Work – Pacific Legacy conducted the Phase 1 AIS of approximately 1,450 acres (587 ha) in 2007 that consisted of a 100 percent pedestrian survey of the area considered for development. The survey identified 169 archaeological sites comprising more than 1,053 features. Pacific Legacy prepared a technical report to document the survey findings. Using data provided by this survey, engineers designed the Auwahi Wind project to avoid as many of the archaeological resources as possible, especially avoiding those that were thought to be most sensitive (i.e., ceremonial/religious structures and possible human burials).

For the pedestrian survey, the concept of archaeological feature was used as the basic unit of recording. An archaeological feature is defined as a spatially discrete unit, made up of two or more single architectural components such as pavements or free-standing walls. When one or more features are contiguous, as in a multichambered structure, it is referred to as a compound structure. Frequently, a number of individual features and compound structures may be found spatially clustered together; these clustered features, which are usually assumed to be temporally or functionally related, are referred to as feature complexes.

The features of the 169 sites represent a variety of resource types, such as traditional ceremonial or religious, burial, habitation, agricultural, transportation, contact/historic period habitation, historic agriculture, and cattle ranching. Many of the larger site complexes contain features that reflect more than one function (e.g., a single site may contain habitation, agricultural, and ceremonial features).

In 2010 and 2011, after the initial project layout was determined Pacific Legacy conducted a Phase 2 AIS. This phase consisted of a detailed recording and testing phase, at multiple archaeological sites within the APE, the result of which are reported in the AIS report (Shapiro et al. 2011a). Feature types excavated within the APE included U-shaped enclosures; C-shaped enclosures; other enclosures (shape not specified); stone-filled terraces; soil-filled terraces; and other terraces (some with overhangs or natural windbreaks). In some cases, these yielded sufficient charcoal and ash deposits for special studies including wood identification, radiocarbon dating, and flotation. Associated dates ranged from fifteenth century to mid-twentieth century. In addition, 409 artifacts, including both pre-Contact period and Historic period artifacts, were recovered from the test excavations within the APE. During the course of fieldwork several ceremonial and burial sites were encountered in the APE. Subsequently, prior to the finalization of the AIS, consultations were held with design engineers and design changes were made so that these sensitive sites would be avoided by construction activities. As a result, additional fieldwork was conducted in April of 2011 to provide detailed recording of sites and features within the revised (current) APE. Results of this supplemental investigation are reported in the Supplemental AIS. Due to the APE revisions, many of the previously recorded site features (including high status residences and ceremonial sites) are now outside of the revised APE.

Of the 264 sites recorded during the 2010 and 2011 fieldwork, portions of a total of 161 sites or feature complexes, composed of more than 638 individual features, are located within the revised APE. A significance assessment, based on National Historic Preservation Act criteria for listing on the National Register of Historic Places (NRHP), and the Hawaii Register of Historic Places (HRHP), was made of the archaeological and cultural resources recorded in 2010 and 2011. See Appendix C for a list of the sites included in the current APE and their significance ratings.

- All of the 161 sites (107 within the wind farm site and along the generator-tie line, 51 along Papaka road, and 3 along Piilani Highway) recorded in the current APE are recommended as potentially eligible to the NRHP under NRHP Criterion (d) because they have either yielded or have the potential to yield information important to the history of Auwahi specifically and more generally for the moku of Kahikinui and the entire island of Maui.

- One within the current APE is also recommended as eligible under NRHP Criterion (c) because of the high degree of workmanship it exhibits in its construction.
- Seventeen within the current APE) are also recommended as potentially eligible to the HRHP under HAR § 13-198-8 significance criteria (e) because they contain human burials or are suspected to contain human burials.

Archaeological resource investigations specific to the Auwahi Wind project HCP have not been conducted within mitigation areas. Previous archaeological investigations in the Kahikinui District suggest that in the steep upper elevations of leeward Haleakala archaeological sites are exclusively temporary in nature with no permanent dwellings or associated agricultural development (Kirch et al. 2004; Dixon et al. 1999). Most sites including primary and temporary habitations, agricultural features, heiau and other sites with ritual functions, boundary markers, shelters, surface midden, burials, and other permanent features appear to be concentrated below 3,000 ft (914 m) in elevation (Kirch et al. 2004; Dixon et al. 1999), but some types of temporary sites may occur above 6,000 ft in elevation if the topography is gentle (Soehren 1963 as cited in DOFAW 2004, NSF 2010). Based on these results, it is anticipated that archaeological surveys of the mitigation areas in the Kahikinui Forest Project (approximately 6,500 to 9,000 ft [1,981 to 2,743 m] in ASL) and the Waihou Mitigation Area (4,800 to 5,500 ft [1,463 to 1,676 m] ASL) would produce few sites, likely consisting of rock shelters, cairns, ridge trails, and other temporary-use sites. Prior to commencing any ground disturbing activities, archaeological surveys would be conducted in the Kahikinui mitigation site, if predator-proof fencing were to become a viable option in the future.

Oral History Interviews – Oral history interviews were conducted during the cultural impact assessments to identify archaeological and cultural resources of Hawaiian cultural value. These interviews apply to the Waihou Mitigation Area and Auwahi Forest Restoration Project mitigation site proposed under the HCP, as well as the Auwahi Wind project. The oral histories indicated that no one was living in Auwahi by the 1930s. The residents of Kanaio would venture into Auwahi to fish from the coast or to gather salt from the salt pans. Since the 1960s, access to the lands of Auwahi has been limited to Ulupalakua Ranch employees, many of whom hunted, fished, and collected shellfish from this area. Most people who knew the area first hand are dead (CKM 2010). It was reported that many of the cowboys who worked on the Ulupalakua Ranch were superstitious about the area that contains the Auwahi Wind project because of the supposed large number of burials in lava tubes there. It is believed that, in the past, the climate was more favorable (i.e., less dry) allowing for cultivation of sweet potatoes. During dry seasons, local populations fished. They may also cultivated taro and used that for trade with other groups in nearby areas.

Pre-contact populations within the analysis area may have been quite large. One elder spoke of the "Red Light District" and the trails that the fisherman used to negotiate with the farmers. The fishermen would dry the fish and, when the negotiation was complete, would burn a red fire, bundle up the fish, and walk up the trails to trade. He mentioned that some of the trails still exist today. This elder also believed that many of the pre-Contact inhabitants divided their time seasonally between two hale, one inland and one makai. His interpretation of the meaning of Auwahi is the presence of "The Heat Raising" (CKM 2010).

One Ulupalakua Ranch employee reported seeing a grass shack that was in the middle of the lava flow. He reported that the shack remained until 1956 (CKM 2010).

Another local informant from Auwahi reported that he had discovered evidence that suggests that the pre-Contact community in Auwahi had developed a series of aqueducts that allowed them to slow down, store, and use the water during flash floods. These extensive rock walls that run all the way up the mountain appear to be dam-like structures to diffuse the water. He suggested that the manpower that it would have taken just to maintain this water system would have been extensive, requiring a large full-time workforce to manage it year-round. Based on this theory and the extensive rock foundations in the area, he believes that the population of the community was large, possibly in the thousands.

Oral history investigations conducted for this project focused on the Auwahi area. A comprehensive review of ancient Hawaiian settlement patterns, demographics, and agricultural practices in the Kahikinui district, covering the petrel mitigation site in the Kahikiniui Forest Project, are provided in (Dixon et al. 2004). Additional information on cultural resources in the vicinity of the Kahikinui mitigation site, focusing on the summit area of Haleakala, are summarized in the Supplemental Cultural Impact Assessment for the ATST project (Dagan et al. 2007).

3.14 SOCIOECONOMIC RESOURCES

Socioeconomic data describe the population, economic condition, and quality of life. Population data include the number of residents in the area and the recent changes in population growth. Data on employment, labor force, unemployment trends, income, and industrial earnings describe the economic health of a region. The number and type of housing units, ownership, and vacancy rate can be indicators of the regional quality of life. The analysis area for socioeconomic resources includes Maui County.

Population, Diversity, and Economy – The population in Maui County in 2010 was estimated at 135,838 individuals. Maui County has experienced a dramatic population increase since the 1970s, and its resident population is projected to increase by approximately 50 percent from 117,644 in 2000, to 176,687 in 2030 (County of Maui 2010d). The ethnic diversity of Maui County is similar to that of Hawaii with a few differences; Maui County reports more white persons and fewer Asian persons and black persons (Table 3.14-1). The median household income in Hawaii ($66,701) is similar to that of Maui ($64,150); poverty rates are also similar between the state and Maui County at 9.30 percent and 9.0 percent of families, respectively (Quickfacts, U.S. Census Bureau 2010).

Table 3.14-1. Ethnic diversity, income, and poverty of Maui County and Hawaii.

Population	Maui County	Hawaii
Population, 2009 estimate	145,157	1,295,178
White persons, percent, 2009 1/	40.00%	30.20%
White persons not Hispanic, percent, 2009	34.40%	25.10%
Asian persons, percent, 2009 1/	28.70%	38.80%
Persons reporting two or more races, percent, 2009	19.20%	18.00%
Native Hawaiian and Other Pacific Islander, percent, 2009 1/	10.60%	9.20%
Persons of Hispanic or Latino origin, percent, 2009 2/	10.20%	9.00%
Black persons, percent, 2009 1/	0.90%	3.20%
American Indian and Alaska Native persons, percent, 2009 1/	0.50%	0.60%
Persons per household, 2000	2.91	2.92
Persons below poverty level, percent, 2008	9.00%	9.30%

Source: Quickfacts, U.S. Census Bureau 2010

1/ Includes persons reporting only one race.

2/ Hispanics may be of any race, so also are included in applicable race categories.

The proposed Auwahi Wind project and mitigation sites would be located in a rural area known for its open space, cattle ranching, sugar cane, vegetable and flower exports, and luxury homes. Of the four counties in the state, Maui's economy is most reliant on tourism. The majority of Maui firms are small businesses with a significant number of self-employed workers representing the labor force (approximately 30 percent). The Draft Maui Island Plan (County of Maui 2010b) includes goals to attract high-technology industries, support the expansion of agriculture and potential growth sectors of agriculture, sports and recreation, healthcare, film and entertainment, and renewable energy production (County of Maui 2010b).

The Makawao-Pukalani-Kula Community Plan (Maui County Council 1996) states that the welfare of this region depends on the county as a whole because residents often work outside their communities. The arts, entertainment, and recreation, accommodation, and food services sector employed the greatest number of workers in the county in 2000 and 2008. The second largest employer sector was the educational services and health care and social assistance sector. The Draft Maui Island Plan (County of Maui 2010b) states that a large proportion of jobs in Maui County are low-wage jobs, often related to tourism. The low wages require most households to support themselves with two or more jobs, because of the high cost of living and housing.

Environmental Justice – The Auwahi Wind project, the Auwahi Forest Restoration Project, the Waihou Mitigation Area, and the Kahikinui Forest Project are all in a designated Enterprise Zone that is part of a joint state-county effort to stimulate certain types of business activity, job preservation, and job creation in areas where they are most appropriate or most needed. The program is headed by the Hawaii's Department of Business, Economic Development & Tourism (DBEDT). Businesses in certain industries, including wind energy, get tax and other incentives if they meet certain hiring requirements (DBEDT 2010).The EPA has developed technical guidance to ensure that environmental justice concerns are effectively identified and addressed throughout the NEPA process. Suggested measures include identifying areas as low-income if more than 20 percent of the affected area is below the poverty level (as defined by the U.S. Census Bureau) or identifying areas as minority areas if minority populations represent more than 15.72 percent of the total population. Minorities are typically defined as individuals who are members of the following population groups: African Americans, American Indians, Alaskan Natives, Asians, Hispanics, Native Hawaiians, or Other Pacific Islanders. As recognized in the Hawaii Environmental Justice Initiative Report (Kahihikolo 2008), the minority population distribution of Hawaii differs greatly from that of the continental U.S. For this reason, Act 294 was passed to define environmental justice in the unique context of Hawaii and to develop and adopt an environmental justice guidance document that addresses environmental justice in all phases of the environmental review process (Kahihikolo 2008).

The ethnicity data for Maui County in Table 3.14-1 shows that the County has a mixture of ethnic groups that, with a couple of exceptions, is similar to that of the state as a whole. Persons reporting two or more races and Asian persons represent more than the EPA-prescribed 15.72 percent of the population; however, the concentrations of these groups are similar to those of the state of Hawaii and should be considered in this setting. According to 2010 U.S. Census data, only 9 percent of the population of Maui County lives below the poverty level.

3.15 HAZARDOUS AND REGULATED MATERIALS AND WASTES

In this section, the term "hazardous materials" refers to any biological, chemical, or physical material that has the potential to harm humans, animals, or the environment, either by itself or through interaction with other factors (Institute of Hazardous Materials Management 2010). Hazardous materials and wastes are subject to many regulations at the federal, state, and local levels. The primary federal agencies responsible for regulating hazardous materials and wastes are the EPA, the Occupational Safety and Health Administration (OSHA), and the U.S. Department of Transportation. The analysis area for hazardous and regulated materials and wastes is defined as the proposed Auwahi Wind project, surrounding areas that could affect or be affected by conditions at the project site, mitigation areas, and the routes of travel to and from these areas.

A Phase I Environmental Site Assessment (Tetra Tech 2008b) of the Auwahi Wind project was done in 2008 to assess the potential presence of hazardous materials on the site. The Phase I was conducted in accordance with American Society for Testing Materials (ASTM) International Standard E1527-05, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process,* and included a visual site inspection, interviews with persons familiar with the property, and a review of current and historical property records. The Phase I assessment did not find evidence that hazardous materials, solid waste, or petroleum products have been released to the environment in or around the proposed project. There was no evidence of the presence of underground storage tanks; storage of hazardous materials; improper disposal of hazardous wastes, dumping, or landfilling; or wastewater such as pits, ponds, or lagoons. There were no structures such as houses or sheds or evidence of utilities such as transmission lines or transformers on the property. Several aboveground storage tanks to supply water to cattle on drier portions of the property were observed (Tetra Tech 2008b). The mitigation sites are remote and there are no known sources of hazardous materials.

3.16 PUBLIC AND CONSTRUCTION SAFETY

Public and worker safety concerns associated with the construction and operations of a wind power project are unique and the focus of this section. Compared to other types of generating facilities, wind power projects use few hazardous materials and generate few such wastes. However, WTGs are generally more accessible to the public, and risks to public health and safety can be associated with these facilities. Examples of such safety concerns include tower collapse, blade throw, stray voltage, fire in the nacelle, and lightning strikes. Other potential safety concerns associated with the proposed project include electric and magnetic fields (EMF). These concerns apply to people working in the wind farm site in association with post-construction fatality monitoring under the HCP, as well as people involved in construction and operation of the wind farm site.

The Auwahi Wind project is currently composed of open pastureland used for Ulupalakua Ranch's active ranching operation. The mitigation sites are also in remote areas not readily accessible by the public. Much of the Ulupalakua Ranch land is fenced and public access is restricted. There are no significant public safety hazards associated with the existing pastureland or ranching operation. For information on the public facilities in the area such as police, fire, and medical services see Section 3.17 – Public Infrastructure and Services.

The area surrounding the mitigation sites and the Auwahi Wind project has a limited history of fire incidents. The occurrence of lightning in Hawaii is rare. No incidences of lightning strikes at Ulupalakua Ranch have been reported. More information about lightning strikes, wildfires and fires that originate within the WTG is found in Section 3.4 – Natural Hazards.

3.17 PUBLIC INFRASTRUCTURE AND SERVICES

This section addresses the availability and capacity of public infrastructure and services, including utilities, waste disposal, police and fire protection, health care facilities, education facilities, and recreational facilities. For this evaluation, the analysis area includes the Auwahi Wind project, mitigation sites, and the surrounding area serviced by utility providers on Maui.

Electric – The sole electrical utility in Maui County is MECO. It has two plants on Maui, with a total generating capacity of 246.3 MW. Seventy-nine percent of the county's electric power comes from imported oil; the remainder is generated from alternative energy sources including biomass, wind, and hydropower. The wind farm site does not have electric power, and the nearest existing utilities are approximately 5.5 miles (8.9 km) from the site entrance. There is an existing MECO transmission line in the general vicinity of the proposed generator-tie line. None of the mitigation sites have electric power.

Solid Waste – Solid waste service is not currently available at the wind farm site. There are several public and private landfills on Maui that accept various types of refuse and hazardous wastes, namely Central Maui Sanitary Landfill in Puunene, Central Maui Sanitary Landfill, Maui Demolition and Construction Landfill in Kihei, Maui Demolition and Construction Landfill, and Unitek. Commercial recyclers on the island accept scrap metal for recycling, and compost facilities such as the Maui EKO co-composting facility at the Central Maui Sanitary Landfill accept green waste.

Water and Waste Water – Water supply services for most areas of the county are provided by the county's Department of Water Supply. Water pumped from underground aquifers is the main source of water for Central Maui, East Maui, Molokai, and supplements the Lahaina and Upcountry water systems. Treated surface water is the primary source of water for upcountry and Lahaina. The county's Department of Environmental Management has three wastewater reclamation facilities located on Maui in Kihei, Wailuku-Kahului, and Lahaina.

The wind farm site does not currently receive water or wastewater services. There is no public water supply along the proposed generator-tie line or at the mitigation sites. The proposed interconnection substation site has access to infrastructure for water and wastewater services.

Police and Fire Protection Services – The location of the Auwahi Wind project is designated as a County of Maui Fire Department primary response area. The closest fire station to the wind farm site and most of the generator-tie line corridor is in Kula, with an additional station in Makawao. The Maui Police Headquarters are in Wailuku, and the closest police station is in Kihei.

Health Care Facilities and Emergency Medical Services – The nearest hospital is the Kula Hospital, in Kula approximately 7 miles (11.3 km) north of the wind farm site. Kula Hospital is a "critical access hospital" and does not receive ambulances. Ambulances are directed to Maui Memorial Hospital in Wailuku. Air ambulance service is available.

Education Facilities – There are no public schools or facilities within or adjacent to the Auwahi Wind project facilities or the mitigation sites. The closest elementary school is Kula Elementary, approximately 12 miles (19.3 km) north (by car). There are no public intermediate or high schools located in the vicinity of the Auwahi Wind project. The nearest intermediate school is Samuel Enoka Kalama Intermediate School, in Makawao, approximately 19 miles (30.6 km) north of the wind farm site. The closest high school is King Kekaulike High School, in Pukalani, approximately 17 miles (17.4 km) north of the site.

Recreation Facilities – There are several recreational facilities in the proposed project vicinity. Haleakala National Park is on Haleakala summit, approximately 8 miles (12.9 km) northeast of the wind farm site. Kula Forest Reserve is approximately 4 miles (6.4 km) north of the site. The Kanaio NAR is adjacent to the proposed wind farm and generator-tie line corridor. The 5.5-mile (8.9-kilometer) Hoapili Trail, part of Na Ala Hele, the state of Hawaii Trail and Access Program, is immediately south of the wind farm site. The Makena-Wailea coastline, west of the wind farm site and near the proposed interconnection substation, has several resort hotels, golf courses, Makena State Park, Ahihi-Kinau NAR, and notable beaches.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This section discusses potential impacts to the affected environment as a result of Alternative 1 – No Action, Alternative 2 – the Proposed Action (issuance of an ITL/ITP and approval of an HCP for the proposed Auwahi Wind project), and Alternative 3 – Reduced Permit Term. The discussion for each resource is divided into three primary sections: 1) effects associated with the issuance of the ITP and implementation of the HCP including the implementation of conservation measures, mitigation, and monitoring; 2) effects associated with construction and operation of the proposed Auwahi Wind project; and 3) cumulative effects.

This analysis addresses direct, indirect, and cumulative effects to each resource that has the potential for environmental impacts. Direct effects are impacts that are caused by the proposed action and occur at the same time and place. Indirect effects, which are caused by the action, are later in time or farther removed in distance, but are still reasonably foreseeable. Cumulative Effects are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions" (40 CFR § 1508.7). The cumulative effects analysis is described in detail below.

To determine if an impact is major, CEQ regulations also require the consideration of context and intensity of potential impacts (40 CFR 1508.27). Context generally refers to setting, whether local or regional (described below as the analysis area for each resource), and intensity refers to the severity and duration of the impact. Impacts are categorized under one of the four levels of significance: negligible, minor, moderate, or major. For this analysis, these terms are defined as follows:

- Negligible: A negligible impact would result in no change to a resource, or a change so small it would not be measureable. Negligible impacts are considered less than significant.
- Minor: A minor impact would result in a change to a resource, but would be small, localized, and of little consequence. Minor impacts are considered less than significant.
- Moderate: A moderate impact would result in a measurable change to a resource, requiring mitigation. Implementation of mitigation would result in the downgrading of impact intensity from moderate to minor or negligible.
- Major: A major impact would result in a substantial change to the character of a resource over a large area, and even through mitigation would not be made less than significant.

For the purposes of this analysis no impact and negligible impact are synonymous. In addition, impacts may be adverse and beneficial within a single resource category.

Measures for avoiding and minimizing project-related impacts to Covered Species that would be implemented under the HCP are listed above in Section 2.2.3.2. Some of these measures also apply to other resources and are identified below. Additional avoidance and minimization measures for other resources, including BMPs associated with construction and operation of the Auwahi Wind project are described in Section 2.2.4 and listed in Table 2.2-4 and referenced under the appropriate resource sections.

4.1.1 Cumulative Effects Analysis

This section describes the analysis of potential cumulative effects associated with the issuance of an ITP for the Auwahi Wind project which is presented in the following four parts within each of the resource analyses:

- The basis for the assessment, including the regulatory framework, the scope of the analysis, and the cumulative impact analysis area (CIAA) by resource (Section 4.1.1.1);
- A summary table and brief descriptions of the relevant past, present, and reasonably foreseeable actions that could contribute to a cumulative effect (Section 4.1.1.2);
- The potential cumulative effects of each alternative when considered together with the relevant past, present, and reasonably foreseeable actions (Section 4.2 to 4.18); and
- The conclusions reached in this evaluation by resource (Section 4.2 to 4.18).

Based on the regulatory framework, the assessment area, the issues raised during and after scoping, and the list of projects presented here, a cumulative impact analysis was conducted for each resource that would be impacted by the Auwahi Wind project and a discussion by alternative is included under each resource.

4.1.1.1 Basis for Assessment

Regulatory Framework

This evaluation of potential cumulative effects from the Proposed Action and alternatives is consistent with the following regulations and guidance:

- CEQ Regulations for Implementing the Procedural Provisions of the NEPA (40 CFR Part 1500-1508, 1978 as amended) (CEQ 1986);
- USEP' Procedures for Implementing the Requirements of the CEQ on the NEPA (40 CFR Part 6 [2009]);
- CEQ Guidance for Considering Cumulative Effects under the NEPA (January 1997) (CEQ 1997b);
- EPA Guidance for Consideration of Cumulative Impacts in EPA Review of NEPA Documents, EPA 315-R-99-002 (May 1999); and
- USFWS NEPA Reference Handbook (550 WL 1.7; 505 WL 1).

Scope of the Analysis

A complete picture of forces already acting upon a particular environmental resource is essential in making reasonable decisions about the management of that resource. If sources of impact exist, whether they are on private or public land, or whether they were taken in the past, are ongoing now, or have a reasonable chance of occurring in a future when the impacts of the proposal are also ongoing, their combined impacts give decision-makers and the public a clear idea of the "absolute" impact the resource is experiencing.

Spatial and temporal boundaries are the two critical elements to consider when deciding which actions to include in a cumulative effects analysis. Spatial and temporal boundaries set the limits for selecting those actions that are most likely to contribute to a cumulative effect. The effects of those actions must overlap in space and time with the effects of the issuance of the ITP and implementation of the HCP and of the construction and operation of the Auwahi Wind project for there to be potential cumulative effects.

For the purposes of this analysis, the temporal extent used to identify projects to be considered in the cumulative effects analysis is the expected physical operational life of this Auwahi Wind project (approximately 20 years) and term of the ITP (25 years, which includes site rehabilitation and decommissioning activity if the project is not repowered). This time period encompasses the reduced permit term (21 years) under Alternative 3. Past and present events and projects are generally identified and their ongoing impacts discussed. "Reasonably foreseeable actions" are proposed projects or actions that have applied for a permit from local, state, or federal authorities or which are publicly known.

The spatial extent used to identify projects to be considered in the cumulative effects analysis varies by resource. For some resources, the CIAA consists of the "footprint" of the Proposed Action which includes all effects associated with the issuance of the ITP and implementation of the HCP, and construction and operation of the Project. Thus the Proposed Action footprint includes the mitigation sites located in the Auwahi Forest Restoration Project, the Kahikinui Forest Project, the Waihou Mitigation Area, and all ground disturbance associated with each Auwahi Wind project facility plus the additional surrounding area that could be disturbed during construction (maneuvering of construction vehicles, equipment staging, etc.). This footprint is the same under Alternative 3, but for consistency is referred to as the Proposed Action footprint below. In several cases, the CIAA for a given resource is substantially larger than the corresponding Proposed Action footprint in order to consider an area large enough to encompass likely effects from other projects on the same resource (i.e., water resources or air quality). Mitigation areas and Auwahi Wind project facilities are shown in Figure 2-1.

The Proposed Action footprint was then overlaid on various resource extents. Based on a visual inspection, if the footprint intersected a larger area (e.g., a watershed or jurisdictional boundary), then the entire larger area was included as the CIAA for that resource. Table 4.1-1 defines the CIAA considered for each resource.

Table 4.1-1. Cumulative impact analysis area by resource.

Resource	Definition of Cumulative Impact Analysis Area (CIAA)	Rationale for Area
Climate	East Maui	Climate change impacts from GHG emissions occur on regional and larger scales.
Geology and Topography	Proposed Action footprint	Impact restricted to immediate areas where ground disturbance would occur.
Soils	Proposed Action footprint	Impact restricted to immediate area where ground disturbance would occur.
Natural Hazards	East Maui	Natural hazards occur on a regional scale.
Hydrology and Water Resources	Kanaio, Kipapa, Wailea, Ahihi, and Mooloa, Kipapa, watersheds (within the larger East Maui watershed); Kamaole, Nakula, and Lualailua aquifer subunits.	Watersheds and aquifers intersected by the mitigation sites and Auwahi Wind project facilities.
Vegetation	Proposed Action footprint plus 0.25-mile buffer	Adequately covers the proposed disturbance areas and area where invasive plant introduction/spread impacts could occur.

Table 4.1-1. Cumulative impact analysis area by resource.

Resource	Definition of Cumulative Impact Analysis Area (CIAA)	Rationale for Area
Wildlife		
Non-listed Wildlife, State-listed species, MBTA-protected	Proposed Action footprint plus 0.5-mile buffer	Reasonable distance beyond which construction or operation of the Proposed Action or other projects is unlikely to disturb nesting birds.
Hawaiian petrel	Island of Maui	HCP addresses the Maui petrel population.
Hoary Bat	Island of Maui	Captures impacts of other wind projects on the Maui population.
Hawaiian goose	Island of Maui	Captures nearby Haleakala National Park population, proposed mitigation site, and other wind farms that could impact the Maui population.
Blackburn's sphinx moth	Island of Maui	Capture impacts of other development projects on Maui.
Land Use	Island of Maui	Level at which land use regulations, plans, or authorizations are in effect.
Transportation	Existing roads used for the Auwahi Wind project, the Maui Airport, and Kahului Harbor.	Where traffic and transportation impacts would occur in association with the HCP and Auwahi Wind project.
Visual	Viewshed for the Auwahi Wind project plus the leeward slope of Haleakala.	Furthest distance within which the Auwahi Wind project is visible, given visual attenuation in this landscape, plus areas from which mitigation activities in the Waihou Mitigation Area and Kahikinui Forest Project might be visible.
Air Quality	East Maui	Impacts to air quality occur on a regional scale.
Noise	Construction: 2,000 ft from construction noise sources; Operation: wind farm site and generator-tie line corridor width.	Areas beyond which no noise from construction at the mitigation sites or construction or operation of the Auwahi Wind project would be detectable above EPA or Hawaii Community Noise Regulations recommended levels.
Archaeological and Cultural	Proposed Action footprint	Includes areas were disturbance of archaeological resources could occur.
Socioeconomics	Maui County	Corresponds with the socioeconomic and environmental justice analysis area.
Hazardous and Regulated Materials and Wastes	Proposed Action footprint	Impacts would be limited to areas where construction equipment and vehicles would be used.
Public and Construction Safety	Areas occupied by people where crossed by Proposed Action footprint	Construction and operation of the project, includes post-construction fatality monitoring under the HCP, may affect the health and safety of people.
Public Infrastructure and Services	Proposed Action footprint and the surrounding area serviced by utility providers on Maui.	Coincides with the impacts analysis area for this resource.

[1/] The Proposed Action footprint includes all direct effects (associated with issuance of the ITP and implementation of the HCP) and indirect effects (associated with construction and operation of the Auwahi Wind project) addressed in Chapter 3.

4.1.1.2 Projects or Actions Considered in the Cumulative Effects Analysis

The area covered by the HCP is predominantly actively grazed pastureland owned by the Ulupalakua Ranch as there has been little development in the immediate vicinity. Ranching activity would continue throughout the term of the ITP. Off-site mitigation is proposed within the Kahikinui Forest Project (petrels), the Auwahi Forest Restoration Project (Blackburn's sphinx moth), the Waihou Mitigation Area (Hawaiian hoary bat), and the Haleakala National Park (Hawaiian goose) located on the southern and northwestern slopes of Haleakala, respectfully. Table 4.1-2 lists specific projects considered in the cumulative effects analysis and indicates for which resources impacts overlap in space and time with impacts of the Proposed Action. In addition to the projects listed in Table 4.1-2, there will continue to be residential development in portions of east Maui zoned for this use, which on a larger scale have the potential to impact petrels through lighting impacts (grounding) and the Blackburn's sphinx moth through habitat loss. The ongoing impacts of wildfires, feral ungulates, and invasive species, and climate change were also considered in the analysis.

4.2 CLIMATE

4.2.1 Alternative 1 – No Action Alternative

4.2.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, USFWS would not issue the ITP, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Therefore, no long-term reduction in GHG emissions would occur due to the decrease in fossil fuel consumption. Thus, the No Action Alternative would have no adverse impacts to climate characteristics but would also not have the beneficial impacts indirectly resulting from the operation of the wind farm.

4.2.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP and therefore the HCP would not be implemented and the Auwahi Wind project would not be constructed. All of the activities indicated in Table 4.1-2 would likely continue—that is, new energy generation, including but not limited to wind farms, would be constructed; other transmission lines would be permitted and built; residential and commercial development projects on Maui would be implemented; and demand for electricity, especially for renewable energy, would continue to grow. While the current economic situation may slow or postpone these developments, there is no evidence or change in local regulation that would indicate that they will not eventually be constructed. Alternative 1 would not contribute to the adverse or beneficial cumulative impacts related to climate associated with these projects.

4.2.1.3 Conclusion

Alternative 1 would have no effect on climate because no action would be undertaken.

Table 4.1-2. Projects considered for cumulative impacts.

Location	Project Name/Activity	Project Sponsor	Year Planned	Project Description	Past, Present, or Foreseeable	Resource CIAAs Overlapped[1]
Ulupalakua Ranch	Ranching operations	Ulupalakua Ranch	Ongoing	Road, fence, and waterline maintenance, cattle herding; approximately 72 water tanks are located throughout the ranch.	Present	Vegetation; Hydrology and Water Resources; Natural Hazards
Ulupalakua Ranch	Auwahi Forest Restoration Project	Art Medeiros (USGS), various federal, state and local agencies, and community groups	Ongoing	A 188-acre (76-hectare) enclosure located at approximately 1,200 ft (366 m) elevation in the Auwahi parcel. Within this enclosure, ungulates were eliminated, kikuyu grass mats were killed, and a program was initiated to augment numerous native plant species by broadcasting seeds and outplanting nursery-raised plants. Additional enclosures are planned for fencing and other restoration activities.	Present	Wildlife-Blackburn's sphinx moth, Hawaiian hoary bat; Vegetation; Visual Resources; Hydrology and Water Resources; Noise
Leeward Slope of Haleakala	Kahikinui Forest Project	DHHL, DOFAW, Ka Ohana o Kahikinui, and the Leeward Haleakala Watershed Restoration Partnership	TBD	Collaborative land management and forest restoration efforts including ungulate-proof fencing, ungulate/predator removal, and native plant restoration on up to 8,000 acres (3,200 ha). Parcels are owned by DHHL and DOFAW and located along the southern border of Haleakala National Park.	Foreseeable	Wildlife-Hawaiian petrel, Hawaiian hoary bat; Vegetation; Visual Resources; Hydrology and Water Resources; Soils; Noise
Haleakala National Park	Petrel and Hawaiian goose management	National Park Service	Ongoing	The park is conducting Hawaiian goose reintroductions and monitoring; petrel management efforts include fencing, predator control, and monitoring.	Present	Wildlife-Hawaiian petrel and Hawaiian goose

Table 4.1-2. Projects considered for cumulative impacts.

Location	Project Name/Activity	Project Sponsor	Year Planned	Project Description	Past, Present, or Foreseeable	Resource CIAAs Overlapped[1]
Haleakala Ranch	Ongoing ranching and Hawaiian goose management activities	DLNR and Haleakala Ranch	2011-2021	Under an established Safe Harbor Agreement for Hawaiian goose reintroduction, Hawaiian goose recovery activities include habitat management; establishment and/or maintenance of a Hawaiian goose release pen; predator control at breeding and release sites; and Hawaiian goose monitoring. Project goal is to establish a self-sustaining Hawaiian goose population over a 10-year period.	Foreseeable	Wildlife-Hawaiian goose;
Adjacent to the generator-tie line corridor approximately 1 mile (0.6 km) from the top of the ridge heading towards Wailea.	Communication Towers	Civil Defense	N/A	Small communication tower	Past	Wildlife-non-listed wildlife, Hawaiian petrel, Hawaiian goose
Ulupalakua Ranch	Existing roads	Numerous	N/A	There are approximately 91 miles (146 km) of existing pastor roads and 1.7 miles (2.7 km) of county-owned road on Ulupalakua Ranch. They are used for daily ranching activities. The ranch is also crossed by the Piilani and Kula highways.	Past	Traffic; Noise

Table 4.1-2. Projects considered for cumulative impacts.

Location	Project Name/Activity	Project Sponsor	Year Planned	Project Description	Past, Present, or Foreseeable	Resource CIAAs Overlapped[1]
Maui	Existing 69-kV transmission lines	MECO	N/A	As of 2008, MECO owns and operates seven 69-kV overhead transmission lines (MECO 2007). The lines, which supply 72 percent of Maui's total system capacity, transport power from the Maalaea Power Plant, located along North Kihei Road, transporting power to the west Maui area (3 lines), central Maui (2 lines), and south Maui and the Upcountry area (2 lines)	Past	Wildlife-non-listed wildlife;, Hawaiian petrel, Hawaiian goose; Natural Hazards; Vegetation
South Maui	Proposed 69-kV Kihei Transmission Line	MECO	TBD	MECO proposes to construct a 69-kV transmission line from Maalaea to its proposed Kamalii Substation in Kihei (MECO 2009).	Foreseeable	Wildlife-non-listed wildlife, Hawaiian petrel, Hawaiian goose; Natural Hazards
South Maui, near the inter-connection substation	Honuaula	Honuaula Partners, LLC	Ongoing-2022	A 670-acre (271-ha) planned development project including a mix of single and multi-family housing, infrastructure improvements, private internal road system with pedestrian and bicycle pathways, golf courses, parks, and open spaces (PBR 2010). Project HCP being prepared.	Foreseeable	Wildlife-Blackburn's sphinx moth, hoary bat; Visual Resources, Hydrology and Water Resources; Natural Hazards; Noise
West Maui	Kaheawa I Wind Power Wind Energy Generating Facility	First Wind, LLC	2007-2027	Existing 30 MW Kaheawa Wind Power project at Kaheawa Pastures above Maalaea, Maui. Under project HCP, mitigation includes petrel colony management; funding for goose propagation and release or translocation; and bat research.	Present	Wildlife-Hawaiian petrel, Hawaiian goose, Hawaiian hoary bat; Climate; Air Quality; Natural Hazards

Table 4.1-2. Projects considered for cumulative impacts.

Location	Project Name/Activity	Project Sponsor	Year Planned	Project Description	Past, Present, or Foreseeable	Resource CIAAs Overlapped[1]
West Maui, west of Kaheawa I site	Kaheawa II Wind Power Wind Energy Generating Facility	First Wind, LLC	2011-2031	Proposed 21 MW wind power generating facility and related improvements at Kaheawa Pastures. Under project HCP, mitigation includes petrel colony management, goose habitat management, and bat forest restoration and research.	Foreseeable	Wildlife-Hawaiian petrel, Hawaiian goose, Hawaiian hoary bat; Climate; Air Quality; Natural Hazards; traffic
Leeward slope of Haleakala adjacent to the Kahikinui Forest Project	Advanced Technology Solar Telescope (ATST)	National Science Foundation	Ongoing-2060	Facilities include a 143-ft (43.6-m) tall building housing the telescope, an attached support and operations building, and a utility building at the Haleakala High Altitude Observatory. Under project HCP, petrel mitigation includes fencing, ungulate removal, predator control, and monitoring within a 328-acre mitigation area.	Present	Wildlife-Hawaiian petrel
Construction Access Route	Wailea Ike Drive/ Wailea Alanui Drive Intersection Improvement Project	Honuaula Partners, LLC	2012	Modification of Wailea Alanue Drive and Wailea Ike Drive through widening the north and south portions of the intersection to fulfill county zoning requirements. Additional improvements include construction of a concrete curb and gutter, sidewalk and curb ramps, installation of asphalt concrete pavement, relocation and/or modification of the traffic signal system, roadway pavement marking and signing, and revegetation. Project will improve intersection operations as traffic increases over time (Munekiyo & Hiraga 2010a).	Foreseeable	Traffic; Noise

Table 4.1-2. Projects considered for cumulative impacts.

Location	Project Name/Activity	Project Sponsor	Year Planned	Project Description	Past, Present, or Foreseeable	Resource CIAAs Overlapped[1]
Construction Access Route	Piilani Highway/Wailea Ike Drive Road Widening Project	Honuaula Partners, LLC, ATC Makena Holdings LLC, A&B Wailea LLC, and Keaka LLC	2012	Construction of two additional lanes and related improvements on Piilani Highway from north of Kilohana Drive to Wailea Ike Drive at Piilani Highways existing terminus (Munekiyo & Hiraga 2010b).	Foreseeable	Traffic; Noise

[1] Indicates that a past, present, or foreseeable project/activity effect overlaps in space and time with the same type of direct or indirect effect of the proposed Project.

4.2.2 Alternative 2 – Proposed Action

4.2.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Implementation of the proposed HCP is not expected to noticeably adversely affect local or regional climate. The use of vehicles (light trucks) during mitigation fence retrofitting, for predator control, for goose reintroduction efforts, and for forest restoration activities would result in minor, temporary emissions. However, over the long-term, HCP mitigation involving restoration of native forests would result in increased forest biomass and associated carbon sequestration capacities. Research suggests that carbon storage and sequestration play very important roles in climate change by removing harmful carbon dioxide from the atmosphere via photosynthesis in plant matter (Sarmiento et al. 1999). Thus, implementation of the HCP would benefit global climate change.

4.2.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

By altering the atmospheric mixing that occurs as wind passes over a site, WTGs do have the potential to affect certain aspects of the wind regime. However, a wind farm project of the scale proposed would not have the potential to affect temperature, rainfall, humidity, or most other meteorological parameters. The Auwahi Wind project has been sited to benefit from the strong wind resources in this area.

There are potentially beneficial effects on climate from operation of the wind farm. The purpose of the Auwahi Wind project is to deliver renewable energy to the MECO power grid to meet Hawaii's RPS goals. Energy generated by the Auwahi Wind project would replace energy generated by the combustion of fossil fuels, thereby contributing to the State's RPS and result in a long-term reduction in GHG emissions that contribute to global warming. Consequently, there would be a beneficial impact to climate, which would offset any temporary emissions during construction. The project-related effects on GHGs are discussed in detail in Section 4.12 – Air Quality.

4.2.2.3 Cumulative Impacts

Over the long term, operation of the Auwahi Wind project would result in beneficial impacts to climate through the reduction in fossil fuel consumption and subsequent reduction in GHG emissions (Section 4.12.2.2 describes the projected reduction in GHG emissions associated with the Auwahi Wind project). The other operating wind projects on Maui would have similar beneficial impacts to climate. Therefore, taken together these projects would result in a beneficial cumulative effect to this resource.

Federal agencies executing projects under NEPA are charged with determining how those projects contribute to greenhouse emissions and ultimately changes in the global climate. The United Nations Intergovernmental Panel on Climate Change (IPCC) published its most recent sets of 5-year progress reports summarizing worldwide research on global climate change in 2001 and 2007 (IPCC 2007). These reports indicated that some level of global climate change is likely to occur and that there is a significant possibility of adverse environmental effects. There is now a broad consensus among atmospheric scientists that emissions caused by humans have already caused measurable increases in global temperature and are expected to result in significantly greater increases in temperature in the future. However, there is still considerable uncertainty about the exact magnitude of future global impacts and the best approach to mitigate the impacts.

Based on the findings of the IPCC (IPCC 2007) and the Hawaii Climate Action Plan (State of Hawaii Department of Business, Economic Development & Tourism 1998), projected impacts to various resources associated with global climate change Hawaii include:

- A temperature increase of 3 º F (with a range of 1 to 5 ºF) in all seasons by 2100;
- Increased frequency of extreme hot days in summer and increased frequency and intensity of coastal storm events;
- Rising sea levels due to thermal expansion as the oceans warms, and as runoff from melting land based snow and ice accelerates;
- Flooding of low-lying property, loss of coastal wetlands, erosion of beaches, saltwater contamination of drinking water, and decreased longevity of low-lying roads, causeways, and bridges due to sea level rise;
- Shifts in the competitive balance among species due to rapid climate change, which may lead to forest dieback, altering the terrestrial uptake and release of carbon;
- Changes in runoff and water availability influenced primarily by higher temperatures, increased evaporation, and changes in rainfall, which could lead to increased sediment and pollutant runoff during rain events or more severe droughts causing declines in groundwater levels;
- Changes in the composition and extent of Hawaii's native forest ecosystems (non-native species appear to be more tolerant of temperature and rainfall changes than native species and even small changes in climatic conditions have the potential to cause major changes in the cloud cover and precipitation regimes that maintain the rainforests of Haleakala);
- Increased possibility of wildfire under drought conditions; and
- Changes in food resources for seabirds such as the Hawaiian petrel, whose foraging patterns appear to be linked to wind patterns and associated prey productivity in the North Pacific, which could have further reaching population-level effects (Adams and Takekawa 2008).

Operation for the Auwahi Wind project, which would only occur with the issuance of the ITP, is anticipated to have an overall beneficial impact on global climate change. In addition, mitigation activities that involve restoration of native forests would, over the long term, increase forest biomass and thus carbon sequestration capacities. Research suggests that carbon storage and sequestration play very important roles in climate change by removing harmful carbon dioxide from the atmosphere via photosynthesis in plant matter (Sarmiento et al. 1999). Thus, these mitigation activities would also benefit global climate change. However, global climate change itself could impact the Covered Species on Maui through reductions in available habitat or changes in the status of the Covered Species. The HCP includes provisions for responding to such "changed circumstance" which may include modifications to the conservation and mitigation measures deemed necessary through consultation with USFWS and DOFAW.

4.2.2.4 Conclusion

Construction activities associated with HCP mitigation and construction of the wind farm would result in minor, temporary emissions; however, over the long-term native forest restoration efforts proposed under the HCP would benefit global climate change through increased forest carbon sequestration capacities. Operation of the wind farm would also result in long-term beneficial impacts to climate through the replacement of energy generated by the combustion of fossil fuels. Therefore, direct, indirect, and cumulative impacts of implementing Alternative 2 on climate would be minor, temporary and adverse over the short-term and beneficial over the long-term.

4.2.3 Alternative 3 – Reduced Permit Term

4.2.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts of implementing the proposed HCP under Alternative 3 related to climate would be the same as under the Proposed Action.

4.2.3.2 Potential Impacts of the Construction and Operation of the Auwahi Wind Project

Climate impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 would be the same as those described above for the Proposed Action. However, GHG benefits would potentially be reduced unless additional renewable power is added after the project ceases operation.

4.2.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 related to climate would be the same as under the Proposed Action.

4.2.3.4 Conclusion

The impacts of Alternative 3 would be the same as those under Alternative 2. Alternative 3 would result in minor, temporary adverse impacts to climate associated with air emissions and would result in long-term beneficial impacts to climate through forest restoration efforts and by decreasing fossil fuel consumption. Beneficial impacts would be of shorter duration due to the reduced operating period. Thus, direct, indirect, and cumulative effects of implementing Alternative 3 on climate would be minor temporary and adverse over the short-term and beneficial over the long-term.

4.3 GEOLOGY AND TOPOGRAPHY

4.3.1 Alternative 1 – No Action Alternative

4.3.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, no adverse impacts to the geologic resources or existing topography in the analysis area would occur because the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be constructed.

4.3.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP and therefore the HCP would not be implemented and the Auwahi Wind project would not be constructed. Therefore, Alternative 1 would make no contribution to cumulative impacts to geology and topography.

4.3.1.3 Conclusion

Alternative 1 would have no effect on geology and topography because no action would be undertaken.

4.3.2 Alternative 2 – Proposed Action

4.3.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Activities associated with issuance of the ITP and implementation of the proposed HCP would have negligible or no effect on local or regional geology and topography. Ground-disturbing activities at the Waihou Mitigation Area, and at Kahikinui should predator-proof fencing become a viable option in the future, would be limited to specific areas (i.e. fence post locations) associated with exclusion fence installation. Under Tier 1 bat mitigation, retrofitting the fence around the Duck Ponds and Cornwell Spring parcels at the Waihou Mitigation Area would disturb a total of approximately 1.5 acres (0.6 ha); an additional 1.5 acres (0.6 ha) would be disturbed if Tier 3 bat mitigation is triggered in association with retrofitting the fence around the Puu Makua parcel. Within this area, fence installation would require inserting replacement fence posts to a depth of approximately 1 to 2 ft (0.3 to 0.6 m). Installation of a predator-proof fence at Kahikinui for petrel mitigation, should this become a viable option in the future, would result in up to 2.3 acres (0.9 ha) of additional ground disturbance. There would be no impact to topography or geologic formations as a result of the proposed Waihou mitigation fence because it would not require substantial excavation or grading. Localized impacts could occur if in the future if a fence were to be installed at Kahikinui, due to potential need to move large lava boulders along the fenceline, the extent of which would be determined at that time. None of the other mitigation activities proposed (predator trapping or rat control, outplanting of native vegetation, goose reintroductions) would result in substantial ground disturbance. Activities outlined in the proposed HCP are consistent with current activities on conservation lands associated with the mitigation parcels selected for the Proposed Action. Special contract requirements would be incorporated into the fencing contract documents that would specify procedures to be followed should lava tubes or other geologic conditions be encountered during construction.

4.3.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Given the infrequency of volcanic activity at Haleakala, the potential for impacts on construction or operation of the Auwahi Wind project from geologic hazards is negligible. Therefore, activities associated with construction and operation would not result in increased exposure of people or structures to geological hazards. Geologic hazards are discussed in detail in Section 3.4-Natural Hazards. No significant impacts to geologic resources would occur because there are no areas of geologic importance or mineral resources with economic value within the analysis area.

Ground disturbing activities such as clearing and grubbing, topsoil removal, grading, compaction, blasting, utility trenching and placement of aggregate surfacing would be required for construction of WTG pads, access roads, the underground electrical collection system, generator-tie line structures, and operations buildings. This earthwork would cause minor alterations of local topography to create adequate foundation conditions for structures and the appropriate grades for access roads, but would not alter any major topographic features. Auwahi Wind has incorporated the use of existing roads and contours into the project design to the extent possible, thereby reducing the level of topographic disturbance resulting from the project.

In total, the Auwahi Wind project would result in approximately 200 acres (81 ha) of ground disturbance during construction. Permanent disturbance would be restricted to the location of each permanent structure including generator-tie line poles, met tower pole and guy wires, WTGs, buildings, and the permanent access roads, resulting in a total permanent disturbance of approximately 39 acres (16 ha).

Blasting would be conducted in a way that minimizes excessive slopes. Slope stability does not appear to be an issue based on preliminary geotechnical investigations. However, as noted above, design-level geotechnical investigations would be conducted prior to construction to identify geologic conditions that could require additional design consideration or mitigation measures. Disturbed areas would be restored to pre-existing grades, except where permanent surface recontouring is required. All disturbed areas where permanent gravel or aggregate is required would be revegetated. Collectively, as concluded in the Final EIS for the Auwahi Wind project (Tetra Tech 2011) as approved by Maui County, these measures would minimize potential impacts from construction operation of the Auwahi Wind project on geology and topography.

4.3.2.3 Cumulative Impacts

Implementation of the HCP would have negligible impacts to geology and topography due to the minor, localized amount of ground disturbance anticipated in association with fence installation. Mitigation activities that include the removal of ungulates and outplanting of native vegetation would prevent soil damage and increase soil stability. These actions under the HCP would reduce the potential for water- or wind-related soil erosion.

Earthwork for construction of the Auwahi Wind project has the potential to result in soil erosion and modify local topography. Implementation of standard BMPs for soil erosion and restoring disturbed areas to pre-existing grades would minimize these impacts. None of the other foreseeable development projects or restoration projects would overlap the Proposed Action in space or time with respect to impacts to geology or topography. Therefore the direct and indirect effects of the Proposed Action would not contribute to adverse cumulative impacts to geology and topography.

4.3.2.4 Conclusion

Implementation of the HCP would have negligible impacts to geology and topography. Construction of the Auwahi Wind project under Alternative 2 would result in minor adverse impacts to geology and topography associated with ground-disturbing activities; however, the implementation of standard BMPs for soil erosion and restoration of disturbed areas to pre-existing grades would minimize these impacts. Therefore, direct, indirect, and cumulative effects of implementing Alternative 2 on geology and topography, when minimized as proposed, would be minor.

4.3.3 Alternative 3 – Reduced Permit Term

4.3.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Activities associated with implementation of the proposed HCP under Alternative 3 would have negligible or no effect on local or regional geology and topography. Ground-disturbing activities at the Waihou and Kahikinui mitigation sites would be similar to those described under the Proposed Action, except that due to the reduced Tier 3 mitigation requirements under Alternative 3 smaller parcels could be fenced. Depending on the fence alignment, this would likely reduce the total amount of ground disturbance. Under Alternative 3, as under the Proposed Action, there would be no impact to topography or geologic formations as a result of the proposed mitigation fences because they would not require substantial excavation or grading. None of the other mitigation activities proposed (predator trapping or outplanting of native vegetation) would result in substantial ground disturbance.

4.3.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 in relation to geological hazards, areas of geologic importance, important mineral areas, and topography would be the same as under the Proposed Action. The implementation of standard BMPs for soil erosion and restoration of disturbed areas to pre-existing grades (Table 2.2-4) would minimize these impacts.

4.3.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.3.3.4 Conclusion

The impacts of Alternative 3 would be the same as those under the Proposed Action. Therefore, direct, indirect, and cumulative effects of implementing Alternative 3 on geology and topography, when minimized as proposed, would be minor.

4.4 SOILS

4.4.1 Alternative 1 – No Action Alternative

4.4.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. There would be no ground disturbance or vegetation removal. Therefore, no adverse impacts to soil resources would occur under the No Action Alternative. However, under the No Action Alternative there would not be the benefits of increased soil stabilization resulting from restoration of native vegetation or protection from ungulate damage that would occur in association with mitigation under the HCP.

4.4.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Beneficial mitigation activities including native ecosystem restoration which could ultimately benefit soils would not occur. Therefore, Alternative 1 would not contribute to cumulative impacts to soils.

4.4.1.3 Conclusion

Alternative 1 would have no effect on soils because no action would be undertaken.

4.4.2 Alternative 2 – Proposed Action

4.4.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Fence retrofitting at the Waihou Mitigation Area, and installation of a fence at Kahikinui should this become a viable option in the future, would result in some soil disturbance. However, soil disturbance would be limited to the corridor along the fenceline and no soils would be removed from agricultural production. Retrofitting the fence at the Waihou Mitigation Area would not require substantial soil disturbance, except in areas where sections of the fence have to be replaced. It is assumed that for the installation of, or upgrading to, predator-proof fence at Kahikinui and the ATST mitigation site, respectively, some soils would be excavated (i.e., pulverizing rock) along the fencelines, depending on the substrate. However, all soils would be restored after the fence is installed.

Fence installation at Kahikinui, should this become a viable option, would likely require the use of a helicopter to transport materials to one or more temporary staging areas along the fencelines. Fence materials would be transported to the Waihou Mitigation Area via truck to staging areas along existing ranch roads or along the existing fenceline. It is assumed that no grading or earthmoving would be required for the temporary staging areas, so there would be no impact to storm water flow at any of the mitigation sites. Minor impacts on soils could occur in association with fence installation if soil was lost to erosional forces (i.e., wind, water); however, activities that expose soils would be limited and infrequent. Avoidance and minimization measures would include implementing standard BMPs for reducing soil erosion including implementation of a Temporary Erosion and Sediment Control (TESC) plan. Moreover, the removal of ungulates from within the fenceline would prevent soil damage and increase soil stability.

Predator trapping or rat control efforts at the Kahikinui Mitigation Area and, if necessary, predator trapping at the ATST mitigation site may have some potential for movement of soils while traversing between the traps. However, this is expected to be negligible. Likewise, installation of the Hawaiian goose pen in Haleakala National Park would also result in negligible soil impacts.

Outplanting of native trees and other species at the Waihou and Auwahi Forest Project Mitigation Areas would require soil disturbance, but the soils would be placed back around the planting after installation. The restoration of native vegetation would ultimately stabilize soils and enhance habitat for other native species. This would reduce the potential for water- or wind-related soil erosion. None of the other mitigation activities proposed would impact soils.

4.4.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Ground disturbing activities such as excavation, grading, trenching, and vegetation removal increase the potential for erosion of exposed soils by water or wind. Grading and other earthwork associated with construction and operation of the Auwahi Wind project would disturb approximately 200 acres (81 ha), of which approximately 19.5 percent (39 acres, 16 ha) would be permanently disturbed. This comprises approximately 1.1 percent and 0.2 percent of the 18,000 acres (7,284 ha) currently operated by the Ulupalakua Ranch. No impacts to prime or unique agricultural land are anticipated.

During construction, erosion would be minimized using common dust suppression techniques, such as regularly watering exposed soils, stockpiling soils, and stabilizing soils. These measures would reduce erosion by holding soil in place and protecting soil from wind, rain, and other soil removing processes. To minimize impacts associated with soil erosion, the Applicant will prepare a TESC plan that would be implemented by the construction contractor. The TESC plan will include standard storm water BMPs including building during the summer months when rainfall potential is low, using silt fences or hay bales to prevent eroded soil from being transported offsite, and contouring to stop drainage from entering the site and to prevent runoff would also be implemented to reduce the risk of erosion. Temporary ditches and culverts used to capture and convey storm water would be installed in areas of temporary disturbance. Permanent storm water control structures would be installed to prevent erosion where access roads, buildings, storage areas, and parking areas are constructed. Upon completion of construction, disturbed areas would be revegetated; therefore, impacts to soil during construction would be temporary.

During operation, roads, buildings, WTGs, generator-tie lines, and electrical collecting systems would be maintained in good condition to prevent adverse effects on soil resources. Routine servicing of all components of the proposed project typically would not require heavy equipment such as large cranes that would disturb soil and increase erosion, but does require service vehicle access. In the event of a major component replacement (e.g., blades or WTGs), heavy equipment similar to that used during construction would be required and soil disturbance and erosion would result. Likewise, access by larger vehicles would be required for non-routine maintenance of the generator-tie line, which could also result in soil disturbance and erosion. However, in these instances, BMPs similar to those in place during construction would be followed, reducing soil impacts to less than significant. Therefore, as concluded in the Final EIS for the Auwahi Wind project (Tetra Tech 2011) as approved by Maui County, due to the implementation of erosion-reducing engineering and design features, industry-standard BMPs, and project plans (e.g., TESC plan) described above, impacts to soils would be minor.

4.4.2.3 Cumulative Impacts

Implementation of the HCP would have negligible to no effect on soils due to the minor, localized amount of ground disturbance anticipated in association with mitigation fence installation. Mitigation activities that include the removal of ungulates and outplanting of native vegetation would prevent soil damage and increase soil stability. These actions under the HCP would reduce the potential for water- or wind-related soil erosion.

Earthwork for construction of the Auwahi Wind project has the potential to result in soil erosion. Implementation of standard BMPs for soil erosion and restoring disturbed areas to pre-existing grades would minimize these impacts. None of the other foreseeable development projects or restoration projects would overlap the Proposed Action in space or time with respect to impacts to soils. Therefore the direct and indirect effects of the Proposed Action would make a minor contribution to adverse cumulative impacts to soils.

4.4.2.4 Conclusion

The implementation of the HCP would result in minor, localized soil disturbance; construction and operation of the wind project would result in minor, localized short- and long-term soil disturbance. Implementation of standard BMPs would minimize any such adverse impacts. Therefore, direct, indirect, and cumulative effects of implementing the Proposed Action on soils, when minimized as proposed, would be minor.

4.4.3 Alternative 3 – Reduced Permit Term

4.4.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with the implementation of the proposed HCP under Alternative 3 would have impacts to soil resources similar to those under the Proposed Action. Fence retrofitting at the Waihou Mitigation Area and installation of fencing at the Kahikinui mitigation site, should this become a viable option in the future, would result in some soil disturbance. However, soil disturbance under Alternative 3 would potentially be less than under the Proposed Action due to the smaller mitigation acreage required for Tier 3 mitigation (i.e., smaller Tier 3 fenced area within the Puu Makua parcel of the Waihou Mitigation Area and smaller fenced area at Kahikinui). All other soil impacts associated with HCP mitigation and related avoidance and minimization measures under Alternative 3 would be the same as under the Proposed Action.

4.4.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 in relation to soils would be the same as under the Proposed Action.

4.4.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.4.3.4 Conclusion

The impacts of Alternative 3 would be the same as under Alternative 2. Implementation of standard BMPs, as described under the Proposed Action, would minimize any such adverse impacts. Therefore, direct, indirect, and cumulative effects of implementing Alternative 3 on soils, when minimized as proposed, would be minor.

4.5 NATURAL HAZARDS

4.5.1 Alternative 1 – No Action Alternative

4.5.1.1 Potential Impacts of Alternative 1

No impacts to the related to natural hazards would occur under the No Action Alternative because the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be built.

4.5.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Therefore, Alternative 1 would not contribute to cumulative impacts related to natural hazards.

4.5.1.3 Conclusion

Alternative 1 would have no effect on natural hazards because no action would be undertaken.

4.5.2 Alternative 2 – Proposed Action

4.5.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts from natural hazards are assessed qualitatively based on known information about natural hazard occurrences on Maui. The occurrence rate of any natural hazard is very low, and therefore the potential for the measures carried out under the HCP (mitigation and monitoring) to be adversely affected by a natural hazard is also very low.

The potential for fire is a concern for the forest restoration areas that serve as mitigation for the Covered Species (Waihou Mitigation Area and Auwahi Forest Restoration Project). The area of concern is along the pinch point corridor where the generator-tie line runs between the State NAR land and the Auwahi Forest Restoration Project, due to the presence of native vegetation. However, the probability of a fire associated with the generator-tie line is approximately 0.05 percent over the lifetime of the Auwahi Wind project (see the Fire Management Plan in Appendix C of the HCP).

By implementing measures identified in Section 2.2.3.2 which include fire prevention measures, routine monitoring and maintenance of project structures and surrounding vegetation, as well as the measures outlined in the Fire Management Plan, the very low risk of fire impacting HCP mitigation areas would be mitigated to low levels.

4.5.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

The potential for construction or operation of the Auwahi Wind project to be impacted by a natural hazard is low, given the low likelihood of such events. If a volcanic eruption or earthquake occurred near the wind farm site or generator-tie lie, electrical service to the MECO grid would likely be disrupted. Similar events could occur in the event of a hurricanes, tropical storm, or tsunami. Such an occurrence would be out of the Applicant's control. To reduce any risk associated with natural hazards, the Applicant will implement the design features to reduce risk of damage, industry-standard BMPs, and the Site Safety Handbook. The Site Safety Handbook includes measures that would be implemented in the event of a natural hazard. For more information on the Site Safety Handbook, see Section 3.16 – Public and Construction Safety. In the event of an emergency, Papaka Road may be opened for public use to assist in an evacuation.

Lightning Strikes and Wildfires – The risk of lightning strikes in Hawaii is lower than in many continental areas (NOAA 2007). The potential for lightning strikes on construction cranes is low because lightning does not occur very often in the analysis area. Protection systems in construction cranes would be compliant with the International Electrotechnical Commission (IEC) publication 61400-24 (IEC 2010). Likewise, WTGs are designed with lightening receptors and are grounded to mitigate the effects of a lightning strike.

Construction activities have the potential to increase fire risk associated with the use of vehicles and electrical equipment and increased human presence. Sparks from vehicles and construction equipment, spark-producing construction activities such as welding, and improper disposal of matches or cigarettes, for example, could start a fire. There would also be increased presence and use of petroleum products, including oils and lubricants onsite, thereby increasing the potential for fires.

Fire risk associated with WTG operation is very low and will be prevented by the design features of the turbine model selected. The direct drive design of the Siemens 3.0-MW turbine eliminates the gearbox and therefore the need for gearbox lubricating oil inside the nacelle. Thus, this WTG model has no risk of gearbox-related fires which can occur in other turbine models. WTGs proposed for this project have over-temperature sensors that would shut down the WTG if normal temperature limits are exceeded. Maintenance of mechanical and electrical systems in the turbine and nacelle would occur regularly, as recommended by the manufacturer, to limit mechanical failures.

As noted above, fire risk associated with operation of the generator-tie line is also very low. Downed generator tie-lines represent an ignition threat which usually stems from a weather event that causes degraded wood poles to blow over in high winds, or from a hazard tree coming into contact with the line itself. In addition to downed lines, poorly maintained lines can produce sparks and arcing that may cause a fire ignition in rare cases. Thus, design and maintenance is key to the integrity of the line. Therefore, by implementing fire prevention measures, routine monitoring and maintenance of project structures and surrounding vegetation identified in Section 2.2.3.2, as well as the measures outlined in the Fire Management Plan (see Appendix C of the project HCP) the very low fire risk posed by the wind farm and the generator-tie line would be mitigated to acceptable levels.

4.5.2.3 Cumulative Impacts

Implementation of HCP mitigation measures, the construction and operation of the Auwahi Wind project, and all of the ongoing and foreseeable projects would be subject to the same risks associated with natural hazards. There is a low, localized risk of fire in association with the existing and proposed wind projects, transmission lines, development projects, and ongoing ranch operations due to normal vehicle activity and the operation of equipment and facilities. It is anticipated that all projects would implement industry standard measures for reducing fire risk in association with facility construction, operations, and maintenance. Therefore, the direct and indirect effects of the Proposed Action in combination with the other projects would not result in an adverse cumulative impact associated with natural hazards.

4.5.2.4 Conclusion

There is a low risk of fire associated with operation of the Auwahi Wind project, and therefore a low risk that project-associated fires could impact HCP mitigation sites. Implementing fire prevention measures; routine monitoring and maintenance of project structures and surrounding vegetation; as well as the measures outlined in the Fire Management Plan would reduce this risk even further. Therefore direct, indirect, and cumulative effects of implementing the Proposed Action related to natural hazards would be negligible.

4.5.3 Alternative 3 – Reduced Permit Term

4.5.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with implementation of the proposed HCP under Alternative 3 would be the same as under the Proposed Action.

4.5.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 in relation to natural hazards would be the same as under the Proposed Action.

4.5.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.5.3.4 Conclusion

The impacts of Alternative 3 would be the same as those of Alternative 2. Therefore, this alternative would result in negligible impacts associated with natural hazards.

4.6 HYDROLOGY AND WATER RESOURCES

4.6.1 Alternative 1 – No Action Alternative

4.6.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Therefore, the current drainage patterns and groundwater recharge on the site would not be altered. Furthermore, there would be none of the benefits associated with increased soil stability and improved water quality. Therefore, there would be no impact to hydrologic resources under the No Action Alternative.

4.6.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Therefore, Alternative 1 would not contribute to cumulative impacts to hydrology and water resources.

4.6.1.3 Conclusion

Alternative 1 would have no effect on hydrology and water resources because no action would be undertaken.

4.6.2 Alternative 2 – Proposed Action

4.6.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Groundwater – The implementation of the HCP would not result in reductions in groundwater quantity. No irrigation is anticipated to be needed in the Waihou Mitigation Area or the Auwahi Forest Restoration Project for outplantings due to sufficient rainfall in these elevations. Furthermore, reforestation has been shown to result in increased evapotranspiration and lower catchment yields. Over the long term, reforestation efforts contribute to accelerated fog drip and reduce erosion (DOFAW 2004). This can positively affect the watershed by increasing soil moisture, slowing runoff, and increasing infiltration. These processes enhance aquifer recharge and improve water quality.

Surface Water – None of the measures to be implemented under the HCP would directly impact hydrology because they would not involve changes to waterbodies, impacts to drainage features, increased water use, or the creation of new impervious surfaces. Ground-disturbing activities associated with fence installation at the Waihou Mitigation Area, and at Kahikinui if fencing were to become a viable option in the future, have the potential to impact water quality through surface water runoff; however, activities associated with fence retrofitting or installation would follow standard BMPs for minimizing erosion and spill prevention, thereby reducing any potential water quality impacts.

Fencing and the removal of ungulates at the Waihou Mitigation Area would prevent further damage to soil and vegetation. Outplanting of native vegetation at the Waihou Mitigation Area and Auwahi Forest Restoration Project would also reduce the potential for erosion by wind and water, thereby also reducing the potential for sediment to reach surface waters in the vicinity of the mitigation sites.

4.6.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Groundwater – During construction, approximately 60,000 gallons (227,124 liters) per day of water would be required for dust suppression and emergency fire suppression. This water would either be trucked in from an offsite source or would be obtained from an onsite well. Five options for sources of potable and nonpotable water are being considered including potable water from an existing source (Maui County Department of Water Supply (DWS) or ATC Makena Holdings LLC (Makena ATC), brackish water from Makena ATC wells, R1 recycled water from the Kihei Waste Water Treatment Plant, and a new potable water source from an onsite well. Two additional options including the use of the Maui County DWS potable water line at Ulupalakua/Kula and R1 water from the Makena Waste Treatment Plant were considered but eliminated from consideration because they had insufficient water supplies. If an onsite well is required, the well would be constructed within the wind farm site and would tap into the Lualailua aquifer. The amount of water required by the project would be less than one percent of the capacity of this aquifer. Therefore, construction of the Auwahi Wind project would not measurably reduce the quantity of available groundwater in the analysis area. Necessary permits to drill and operate the well would be obtained prior to any construction activity, should Auwahi Wind elect to drill an on-site well.

Construction activities would require the use of hazardous materials such as fuels (e.g., diesel fuel, gasoline), lubricants, cleaning solvents, and paints. If these materials were to enter storm water, they could reduce groundwater quality. Prior to construction, Auwahi Wind would prepare a project Spill Prevention, Containment, and Countermeasures (SPCC) plan in accordance with 40 CFR Part 112. The SPCC would include measures for the safe transport, handling, and storage of these materials. The SPCC plan would be reviewed and certified by a Professional Engineer to ensure its adequacy, and updated periodically. The SPCC plan would detail spill prevention, response, containment, reporting, and cleanup measures; and include worker training requirements, inspection protocols, and emergency procedures. Implementation of the control measures and BMPs that are designed to prevent and respond to spills and releases would ensure that impacts remain less than significant.

During operations, water would be required for use at the O&M building resulting in an average daily demand of 529 gallons (3,006 liters) of water per day, with a maximum daily demand of 794 gallons (6,007 liters) and a peak hour demand of 1.1 gallons per minute (4.2 liters per minute). These estimates are based on HAR § 11-62 and represent a preliminary, conservative estimate. It is anticipated that actual domestic water consumption during project operations would be less. If water were to be sourced from an onsite well as described above, this would result in a very minor increase in demand. If a well was not installed, water for the O&M building would be trucked or pumped in and stored in tanks for operations. Therefore, operations of the Auwahi Wind project would not measurably reduce the quantity of available groundwater in the analysis area. In the event that Auwahi Wind elects to drill an on-site well, a public filling station to supply Ka Ohana O Kahikinui and nearby neighbors with the excess potable water not needed for project operations may be developed. In addition, an irrigation system would be established where the generator-tie line runs adjacent to the Kanaio NAR. This system would be used to keep the vegetation in this area green, thereby reducing fire risk, and would also be used for firefighting should a fire erupt in this area. Water for the system would come from an existing 50,000-gallon tank located 1.2 miles (2 km) west of the generator-tie line. Thus no new water sources would be required for this use.

Increases in impervious surfaces can increase the amount of surface water runoff by preventing the slow percolation of storm water and thus accelerate erosion and sedimentation rates. The Auwahi Wind project would result in a small increase in the amount of new semi-impervious (aggregate) and impervious (concrete) surfaces in the analysis area (approximately 37.3 acres [15.1 ha]) of which only 2.8 acres (1.1 ha) would be truly impervious. Precipitation falling on these new impervious and semi-impervious surfaces would drain to adjacent pervious surfaces, and therefore, substantial changes in storm water runoff are not anticipated and the construction and operation of the Auwahi Wind project would not measurably reduce the potential for groundwater recharge.

Surface Water – Construction of the Auwahi Wind project would not disturb any surface waters or intermittent drainage features. The generator-tie line would span the upper portion of the gully between Makena and Lualailua Hills north of Upcountry Piilani Highway, so no disturbance would occur in the gulch. In addition, the project would be designed to minimize changes to naturally existing topography and drainage and to ensure that during construction storm water is conveyed away from structures or access roads and directed to the designated drainage systems. Therefore, conditions that would increase the potential for flood hazards are not expected.

Ground disturbance associated with construction of the Auwahi Wind project would increase the potential for sediment and other pollutants present onsite to become entrained in storm water runoff and flow into receiving surface waters (Pacific Ocean). To minimize any surface water impacts, Auwahi Wind would prepare a site-specific Storm Water Pollution Prevention (SWPP) plan. The SWPP plan would include BMPs to reduce impacts to hydrology, drainage, and surface waters. As discussed in Section 4.4-Soils, Auwahi Wind would also prepare a TESC plan that would describe erosion control measures to be implemented during construction that would prevent water quality degradation from storm water runoff. Therefore, any project-related impacts to surface water quality, if any, would be highly localized and temporary.

4.6.2.3 Cumulative Impacts

Groundwater – Ongoing ranch activities are supplied with water via a number of onsite wells. The implementation of the HCP would not result in reductions in groundwater quantity; however, over the long term restoration of native vegetation under the HCP would benefit ground water through increased evapotranspiration and lower catchment yields (see Section 3.5 for additional discussion). However, construction and operation of the Auwahi Wind project would require a water supply, anticipated to either come from an existing, permitted source or from an onsite well, which would tap into the Lualailua aquifer. The amount of water required by the Auwahi Wind project comprises less than one percent the capacity of this aquifer. The only known foreseeable project that would require a new water supply from one of the aquifers included in the CIAA for hydrology and water resources is the Honuaula project. However, the wells that will supply the Honuaula property are located in the Kamaole Aquifer System and thus will draw from a separate groundwater supply than the Auwahi Wind project. Therefore, the direct and indirect effects of the Proposed Action, in combination with ongoing ground water uses, would have a minor cumulative impact to groundwater supply.

Surface Water – None of the proposed mitigation measures under the HCP would directly impact surface water bodies. Fence construction under the HCP and construction of the Auwahi Wind project have the potential to impact water quality through surface water runoff. Any potential adverse effect on water quality would be minimized through implementation of standard BMPs for minimizing erosion and spill prevention (e.g., a SWPP plan and TESC plan). Mitigation activities involving the removal of ungulates from within fenced areas and outplanting native vegetation would prevent further damage to soil and vegetation at the mitigation sites. This would reduce the potential for erosion by wind and water, thereby also reducing the potential for sediment to reach surface waters in the vicinity of the mitigation sites.

Likewise, the Auwahi Wind project would not directly impact surface waterbodies. The project would result in a very minor increase in impervious surfaces within the CIAA associated with permanent facilities (i.e., turbine pads). Other development and restoration projects within the watersheds crossed by the CIAA for hydrology and water resources would also have the potential result in water quality impacts due to construction-related erosion or accidental spills. It is assumed that standard BMPs for reducing water quality impacts would be implemented in all cases. None of the projects, with the exception of the Honuaula, would result in substantial amounts of impervious surfaces. Therefore, the direct and indirect effects of the Proposed Action in combination with ongoing and foreseeable actions would result in a minor cumulative impact to water quality.

4.6.2.4 Conclusion

Any adverse project-related impacts to surface water quality, if any, would be highly localized and temporary due to the implementation of standard BMPs such as a SWPP plan and TESC plan. There would be no measureable reduction in the quantity of available ground water associated with an onsite well. Implementation of mitigation measures under the HCP would ultimately benefit water resources by increasing soil moisture, slowing runoff, increasing infiltration, and preventing soil damage which would reduce the potential for sediment to reach surface waters in the vicinity of the mitigation sites. Therefore, the direct, indirect, and cumulative effects of implementing the Proposed Action on hydrology and water resources would be minor.

4.6.3 Alternative 3 – Reduced Permit Term

4.6.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with implementation of the proposed HCP under Alternative 3 related to hydrology and water resources would be the same as under the Proposed Action.

4.6.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 related to hydrology and water resources would be the same as under the Proposed Action.

4.6.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.6.3.4 Conclusion

The impacts of Alternative 3 would be the same as those under the Proposed Action. Implementation of standard BMPs would minimize adverse impacts to surface water; no measureable reduction in ground water would occur. Mitigation under the HCP would reduce the potential for sediment to reach surface waters in the vicinity of the mitigation sites. Therefore, direct, indirect, and cumulative effects of implementing Alternative 3 on hydrology and water resources would be minor.

4.7 VEGETATION

4.7.1 Alternative 1 – No Action Alternative

4.7.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Therefore, there would be no effect to vegetation communities or special status and rare plant species, including the benefits of restoration of native vegetation associated with HCP mitigation.

4.7.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Beneficial mitigation activities including native ecosystem restoration would not occur. Therefore, Alternative 1would not contribute to cumulative impacts, either adverse or beneficial, to vegetation.

4.7.1.3 Conclusion

Alternative 1 would have no effect on vegetation resources because no action would be undertaken.

4.7.2 Alternative 2 – Proposed Action

4.7.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Proposed mitigation measures for the Covered Species under the HCP include habitat restoration in the Auwahi Forest Restoration Project and the Waihou Mitigation Area. Ongoing management of these mitigation areas focuses on the preservation, management, and restoration of remnant native or degraded ecosystems with the goal of creating or enhancing habitat for rare or listed plant and wildlife species including the Covered Species. Activities proposed under the HCP would have beneficial impacts to native vegetation in these areas, if present.

Fence installation at the Waihou Mitigation Area under the HCP would require ground disturbance and, therefore, have the potential to clear areas of native vegetation. Retrofitting of the Duck Ponds and Cornwell Spring parcels under Tier 1 bat mitigation would disturb approximately 1.5 acres (0.6 ha). Should Tier 3 bat mitigation be required, this would result in an additional 1.5 acres (0.6 ha) of ground disturbances associated with retrofitting the fence around the Puu Makua parcel of the Waihou Mitigation Area. However, vegetation removal (primarily pasture) would only occur in limited areas along the fenceline where vegetation inhibits fence retrofitting. Installation of the predator-proof fence at Kahikinui, should this become a viable option in the future, would impact up to approximately 2.3 acres (0.9 ha). However, there is little to no vegetation in much of the upper portions of the Kahikinui mitigation site. Surveys for rare and sensitive plant species would be conducted in the Kahikinui mitigation site prior to commencing fence installation to ensure the potential impacts would be avoided or minimized.

Foot traffic and vehicle use associated with petrel monitoring, predator control, Hawaiian goose reintroduction efforts, and forest restoration activities at the mitigation sites, and post-construction monitoring at the wind farm site also have the potential to adversely impact listed plant species. Standard BMPs for invasive plant management would be implemented to minimize adverse impacts to native vegetation communities at all mitigation sites. Field-gear-cleaning procedures for construction equipment and vehicles would be enforced for Auwahi Wind project biologists conducting monitoring and construction contractors to reduce the introduction of invasive plant seeds and propagules, as well as arthropods such as exotic ants. As part of ongoing post-construction fatality monitoring at the Auwahi Wind project, foot traffic may trample existing vegetation. However, impacts are expected to be temporary and negligible.

Over the long term, restoration activities carried out or funded by Auwahi Wind under the HCP would allow native forests to regenerate through long-term protection (i.e., fencing) and/or enhancement (i.e., outplanting of native species). Fencing at the Waihou Mitigation Area and the Kahikinui mitigation site, should this become a viable option in the future, would reduce grazing, browsing, and trampling of native vegetation by ungulates and over the long term would facilitate the regeneration of species associated with native forest and subalpine ecosystems, respectively. Additionally, reforestation efforts at the Waihou Mitigation Area and Auwahi Forest Restoration Project have the potential to create or enhance habitat for rare or listed plant species by restoring remnant native or degraded ecosystems. Thus, through natural regeneration, benefits to vegetation associated with these mitigation measures are anticipated beyond the lifespan of the HCP.

4.7.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Vegetative Communities – Construction of the Auwahi Wind project would disturb approximately 200 acres (81 ha) during construction, primarily consisting of scrub/shrub vegetation (37 percent) and grassland/pasture (39 percent). Total and temporary construction impacts to vegetation communities associated with the Proposed Action are listed in Table 4.7-1. Areas temporarily disturbed during construction would be revegetated using native plants or approved pasture grasses.

Table 4.7-1. Estimated temporary and permanent disturbance associated with the Auwahi Wind project by vegetation community.

	Disturbance (acres)		
	Temporary	Permanent	Total
Grassland/Pasture	65.4	12.8	78.2
Scrub/Shrub	59.7	13.4	73.1
Savanna	13.9	7.5	21.4
Mixed Native Forest[1/]	20.7	5.5	26.3
Secondary Forest/Non-native	0.6	0.0[3/]	0.6
Disturbed/Developed	0.2	0.1	0.3
Total[2/]	160.6	39.3	199.8

Totals may not add up due to rounding. 1 acre = 0.4 hectare

[1/]Kieawe, koa haole, wiliwili

[2/]Does not include disturbance associated with mitigation activities.

[3/] Less than 0.1 acre

Construction of the Auwahi Wind project would result in ground clearing for installation of project structures (WTGs, transmission line poles, roads) and temporary disturbances to vegetation within the generator-tie line corridor and laydown areas. Given that much of the vegetation potentially affected consists of low-growing non-native species, direct impacts would generally be minor, beyond the localized impacts of structure installation and the construction of roads and other facilities. Existing vegetation within the generator-tie line corridor would remain as long as the fire and safety clearance distances from the line are maintained, which could require limited cutting back of individual trees and shrubs. Following construction, cleared areas around the gravel WTG pads and generator-tie line structures and temporary construction staging and laydown areas, would be reseeded with native vegetation or pasture grasses (the dominant vegetation community on the ranch) and encouraged to return to pre-construction conditions. Thus, vegetation removal associated with the project is not expected to significantly affect botanical resources, given the general degradation of the habitat and minimal distribution of native communities (e.g., native dryland forest) within the analysis area (Table 4.7-1). There are no large, contiguous blocks of intact vegetation that would be fragmented by the Auwahi Wind project.

Qualified personnel will routinely monitor, inspect, and maintain the components of the wind farm (e.g., WTGs, collector system, and communications equipment) and generator-tie line facilities during project operations. These O&M activities would be accomplished with the use of off-road vehicles and light trucks, which would result in temporary trampling of vegetation if off-road travel is necessary. To minimize new road construction, and thus impacts to vegetation, to access the generator-tie line O&M personnel would use a combination of existing field roads, new gravel road, and two-track road over vegetation. It is anticipated that off-road travel during operations would be rare. However, should a major component replacement be necessary for any of these facilities (e.g., blade or transformer), heavy equipment similar to that used during construction would be required and the access roads, crane pads (WTGs only), and staging areas would be used in a similar manner as with the original construction, resulting in similar disturbance impacts to vegetation with similar mitigation being required.

Other Special Status and Rare Species – Impacts to special status plants are summarized in Appendix D. The Auwahi Wind project has been sited at the current location to avoid the dryland forests reserves within the Kanaio NAR and the dryland forest restoration activities on the Ulupalakua Ranch (the Auwahi Forest Restoration Project). Prior to construction, additional botanical surveys would be conducted to identify occurrences, if any, of special status plant species that may vary in presence from year to year. Special status species within the wind farm site (one red ilima plant and one aiea plant) would be fenced and avoided during construction. Therefore, no direct impacts to special status plant species will occur as a result of construction within the wind farm site.

One rare species, maiapilo, was identified adjacent to the construction access road. Three individual maiapilo occur within an area of temporary disturbance along Papaka Road. Although Auwahi Wind would, to the extent possible, avoid these plants during construction because they are located at the edge of the construction work area, it is conservatively assumed that they may be removed during construction but considered an insignificant impact because of the presence of other maiapilo within and adjacent to the area included in the botanical survey (Appendix B) and because dryland habitat restoration proposed for the Blackburn's sphinx moth will benefit this species.

One endangered plant, iliahi, and one candidate plant species, aiea, were documented within the generator-tie line corridor in areas of permanent and temporary disturbance, respectfully. Because there is some flexibility in the installation of generator-tie line pole locations, these occurrences will be flagged and fenced to ensure direct impacts are avoided during construction. Consequently, no direct impacts would occur to listed or candidate plant species during construction. Indirect impacts including wildfire and the spread of invasive plant species have the potential to occur during construction. Additionally, although there are no contiguous blocks of native vegetation that would be impacted by the Auwahi Wind project, installation of project components would result in minor fragmentation of potential habitat (primarily consisting of pasture grasses) for special status and native plants. However, implementation of standard BMPs for revegetating disturbed areas and measures related to the prevention of project-related fires and the introduction and spread of invasive plant species will minimize these effects (see Chapter 2 for additional discussion of avoidance and minimization measures). In addition, mitigation at the Waihou Mitigation Area (Hawaiian hoary bat) and Auwahi Forest Restoration Project (Blackburn's sphinx moth) on the Ulupalakua Ranch will benefit special status and rare plants that occur in the vicinity of the Auwahi Wind project by protecting and/or restoring native vegetation communities. Further, as described in Section 2.2.4, based on these minimal potential future impacts within the degraded lands on Ulupalakua Ranch, a total of 10 additional plants for each species (aiea, iliahi, and red ilima) will be be planted. Aiea and iliahi, which occur at higher elevations, will be planted into one of the fenced, protected dry forest conservation areas at Ulupalakua Ranch. Red ilima, which occurs at lower elevations than the fenced conservation areas, will be planted and fenced on the Ulupalakua Ranch in an appropriate location as determined by a qualified botanist. Collectively, these efforts will minimize any potential impact to rare and special status plants.

Adverse impacts to special status or rare native plant species during O&M activities are unlikely because disturbance of vegetation would be limited. Fencing around listed plant species would remain during O&M to enable continued avoidance of these species. As noted above, standard BMPs for reducing the spread of invasive plant species during operations and implementing additional fire prevention measures during operations near the Kanaio NAR and the Auwahi Forest Restoration Project would reduce the chance of indirect effects on special status or rare native plants.

With these and other BMPs in effect (listed in Table 2.2-4), disturbance associated with construction and operation of the Auwahi Wind project would be localized and temporary, and is not expected to have a significant effect on increasing invasive species. Auwahi Wind would also consult with the Hawaii Department of Agriculture and Maui Invasive Species Commission to establish protocols and training orientation methods for screening invasive species introductions during construction. During the O&M activities, standard BMPs to control the spread of invasive species would be implemented.

There is also a very slight chance for project-related fires during construction that are related to the presence and use of vehicles and heavy equipment and activities such as welding and grinding that produce sparks. Likewise, there is also a very low risk of fire associated with operation of the WTGs and generator tie line. Implementation of the project FMP (Appendix C of the HCP), which includes requirements for vegetation maintenance, equipment safety features (e.g., spark arrestors), and routine maintenance would minimize the potential for project-related fires during construction and operation. Where the generator-tie line runs adjacent to the Kanaio NAR and the Auwahi Forest Restoration Project, additional fire prevention measures would be implemented during construction to reduce the chance of project-related fires in areas with higher concentrations of rare or native plants. With these mitigations and BMPs in effect, no adverse impacts on vegetation would result from construction or operations of the Auwahi Wind project.

4.7.2.3 Cumulative Impacts

The CIAA for vegetation has very little development; however, past ranching operations have contributed to the overall loss of native vegetation and increased the spread of invasive plant species. There are also invasive plant communities associated with existing road and transmission line corridors. Dryland forest in the reserves adjacent to the generator-tie line and within the mitigation areas include more substantial areas of native vegetation but are degraded in many places.

Implementation of the HCP would benefit vegetation through avoidance and minimization measures that reduce weed populations and mitigation measures that encourage the regeneration of native forests through long-term protection and/or enhancement. These actions would complement the ongoing restoration efforts listed in Table 4.1-2, and would collectively have a beneficial impact to vegetation.

Construction and operation of the Auwahi Wind project would result in some vegetation clearing, most of which is not native, to result in the introduction or spread of invasive plant species. However, standard BMPs for invasive plant management would be implemented to minimize impacts to native vegetation communities, listed plants would be avoided, and rare plants would be avoided where possible. The project FMP would also be implemented to minimize the already low risk of project-related fires on vegetation.

It is expected that other projects within the CIAA for vegetation (Auwahi Forest Restoration Project, Kahikinui Forest Project, and Honuaula project) would also implement standard BMPs for preventing the introduction and spread of invasive plants and other measures for avoiding and minimizing impacts to sensitive and rare plants. Therefore, the direct and indirect effects of the Proposed Action in combination with past, present, and foreseeable projects would have a minor adverse cumulative impact to vegetation.

4.7.2.4 Conclusion

Implementation of HCP mitigation measures would result in negligible, short-term adverse impacts to vegetation due to the limited amount of disturbance; impacts to rare and special status plant species would be avoided. The regeneration of native ecosystems through implementation of HCP mitigation measures would result in long term, beneficial impacts to vegetation. Permanent vegetation removal associated with construction and operation of the Auwahi Wind project would impact vegetation, some of which may provide potential habitat for special status and rare plants, on a very small proportion of ranch lands. No federally listed plants would be directly impacted; a minor number of individual other special status or rare plants may be impacted. Implementation of standard BMPs would minimize potential indirect effects associated with invasive plants, wildfire, and fragmentation of potential habitat for native plants. Additional plantings of iliahi, red ilima, and aiea will benefit these species. Given the general degradation of the habitat and minimal distribution of native communities the direct, indirect, and cumulative effects of implementing the Proposed Action on vegetation, when avoided and minimized as proposed, would be minor.

4.7.3 Alternative 3 – Reduced Permit Term

4.7.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Alternative 3, like the Proposed Action, would have beneficial impacts to native vegetation through native forest regeneration and long-term protection (i.e., fencing) and/or enhancement (i.e., outplanting of native species). However, due to the lower petrel and bat take levels under Alternative 3 (see Chapter 2 for details), fewer acres would be protected and restored at the Waihou and Kahikinui mitigation sites. All other beneficial impacts to vegetation under Alternative 3 would be the same as under the Proposed Action.

Ground disturbance and the potential for impacts to rare and sensitive plant species under Alternative 3 would be similar to the Proposed Action. However, installation of fence around smaller parcels at the Waihou Mitigation Area for bat mitigation and at Kahikinui for petrels, should fencing become a viable option in the future, would result in less ground disturbance and thus a slightly reduced potential for impacts to native vegetation, than the Proposed Action. The already low potential for impacts to vegetation associated with foot traffic from predator control measures (trapping) for petrel mitigation would be further reduced because fewer years of predator trapping would be required under Alternative 3 than the Proposed Action. Under Alternative 3, surveys for rare and sensitive plant species would be conducted in Kahikinui, should fencing become an option in the future, prior to commencing fence installation to avoid impacts to these species. Additionally, standard BMPs and other measures described under the Proposed Action to minimize adverse impacts to native vegetation communities would also be implemented under Alternative 3.

4.7.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 in relation to vegetation would be the same as under the Proposed Action.

4.7.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 related to vegetation would be the same as under the Proposed Action.

4.7.3.4 Conclusion

Impacts to vegetation under Alternative 3 would be similar to those under the Proposed Action. Implementation of HCP mitigation measures and construction of the wind project would result in minor, localized short-term adverse impacts; however, native forest restoration efforts under the HCP as well as additional plantings of iliahi, red ilima, and aiea would result in long-term beneficial impacts to vegetation. Therefore, the direct, indirect, and cumulative effects of implementing Alternative 3 on vegetation, when avoided and minimized as proposed, would be minor.

4.8 WILDLIFE

4.8.1 Alternative 1 – No Action Alternative

4.8.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. This alternative would, therefore, have no new adverse direct or indirect effects on any non-listed wildlife species, MBTA-protected species, Hawaii State species of concern, ESA-listed species, or species under consideration for federal listing. However, under the No Action Alternative there would be no contribution to forest restoration efforts in east Maui or additional management of Hawaiian geese and petrels. There would also be no contribution to knowledge of the Hawaiian hoary bat. Thus, under the No Action Alternative the continuation of current land uses within the analysis area (grazing) would occur without the benefit of habitat restoration, population management, or research associated with HCP mitigation.

4.8.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Beneficial mitigation activities associated with this project including native ecosystem restoration and population management for Hawaiian geese and petrels would not occur. Therefore, the benefits afforded by this HCP to the Covered Species would not occur. All of the activities indicated in Table 4.1-2 would likely continue—that is, new energy generation, including but not limited to wind farms, would be constructed; other transmission lines would be permitted and built; residential and commercial development projects on Maui would be implemented; and demand for electricity, especially for renewable energy, would continue to grow. While the current economic situation may slow or postpone these developments, there is no evidence or change in local regulation that would indicate that they will not eventually be constructed. Projects with the potential to take listed species would presumably have an ITP and HCP to provide benefits to offset the megative impact to listed species. Alternative 1 would not contribute to cumulative impacts to wildlife, including the Covered Species, associated with these projects.

4.8.1.3 Conclusion

No adverse impacts to wildlife would occur under Alternative 1, or beneficial impacts associated with HCP mitigation measures, because no activities would be undertaken.

4.8.2 Alternative 2 – Proposed Action

4.8.2.1 Potential Impacts of the Proposed HCP Conservation Measures

As described in Section 2.2.2.2, under the HCP Auwahi Wind will implement a suite of measures to avoid and minimize impacts to the Covered Species that would also avoid and minimize impacts to other wildlife species. Additionally, post-construction monitoring and implementation of the Wildlife Education and Incidental Reporting program under the HCP would document project-related impacts to all species.

The benefits of HCP mitigation on the Covered Species is discussed in detail below in Section 4.8.2.2 and summarized in Appendix D. As describe in Section 2.2.3.2, mitigation activities are proposed in the Kahikinui Forest Project, Waihou Mitigation Area, and the Auwahi Forest

Restoration Project, and are intended to protect native habitats used by the Covered Species. Thus, they will ultimately have a beneficial impact to other native Hawaiian plants and wildlife in these areas. The following describes anticipated impacts to wildlife associated with mitigation.

Fence retrofitting and restoration activities at the Waihou Mitigation Area would result in short-term disturbance due to worker and vehicle noise and ground disturbance, potentially including the removal of native vegetation. Impacts to sensitive resources at the Waihou Mitigation Area are anticipated to be negligible because the area has been previously disturbed and all activities, including replacement of segments of fence, would occur adjacent to the existing fence. Measures to further minimize impacts to wildlife and habitat may include implementing standard BMPs for reducing soil erosion and the introduction or spread of invasive species; minimizing the area of vegetation clearing; and avoiding the removal of trees during the pupping season (July 1 to August 15). Likewise, Hawaiian goose reintroduction efforts have the potential to result in the temporary disturbance to wildlife if a new pen is constructed, or in association with workers conducting recovery activities at an existing pen in Haleakala National Park.

Fence installation in the upper elevations of the Kahikinui Forest Project, should this become a viable option in the future, has the potential to disturb nesting seabirds; therefore, prior to commencing work, the fence alignments would be surveyed by a qualified biologist to document petrel burrows. The fence alignment at Kahikinui would be adjusted accordingly to avoid adverse impacts to burrows and fence contractors will be trained to identify petrel burrows. Fencing activities would be timed to occur outside the petrel nesting season to minimize noise impacts to nesting birds. To minimize the risk of collision with the fence, it would be marked with strips of poly-vinyl tape to increase visibility.

Predator traps at the Kahikinui Forest Project and at the ATST migitation site would be located such that impacts to burrows can be avoided and traps would be checked regularly to ensure the risk of injuring an accidentally trapped petrel is minimized. Collectively, these measures would minimize any adverse impacts to seabirds.

Minor, temporary disturbance to wildlife would occur in association with mitigation at the Auwahi Forest Restoration Project if bats or Blackburn's sphinx moths are using the area when outplanting occurs. Mitigation at this location would focus on dryland forest restoration, and would include planting native plant species preferred by the Blackburn's sphinx moth; therefore, implementation of this component of the HCP would benefit this and other dryland forest-associated wildlife species. Temporary disturbance to Blackburn's sphinx moth larvae and moths would also occur if preconstruction translocations of individuals from construction areas are necessary to avoid and minimize project-related impacts. All translocations would be conducted consistently to USFWS-approved protocol. Moths would be taken to the nearest suitable habitat away from disturbance and dust exposure to minimize transport time.

4.8.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts to wildlife would occur when habitats or individuals are disturbed or killed during construction or operation of the Auwahi Wind project. Effects to wildlife and wildlife habitat are assessed quantitatively, where possible. Habitat is assessed by acres of wildlife habitat (vegetation) temporarily and permanently disturbed by installation of proposed project facilities (see Section 3.6 – Vegetation). Other effects to wildlife are assessed qualitatively through discussion of noise and disturbance, as well as potential impacts associated with noxious weeds. Effects to state- and federally-listed wildlife species, that latter of which are addressed in the project HCP, are addressed in greater detail.

Potential impacts to approximately 200 acres (80 ha) could result from vegetation removal associated with the construction of project facilities, primarily consisting of grasslands, pasturelands, and savannah. Of this, approximately 39 acres (16 ha) would be permanently removed in association with permanent structure placements (e.g., WTG pads, generator tie-line structures, and access roads). Due to the ongoing ranch operations, wildlife habitat removed or disturbed by the Auwahi Wind project is not high quality. Tree removal would be minor, consisting of the removal of individual trees primarily in association with clearing for the generator-tie line corridor and the construction access route (Papaka Road); however, remnant native vegetation types would be avoided where possible. No additional tree removal would be required during operations of the Auwahi Wind project. Potential habitat removal is summarized by vegetation type in Table 4.7-1.

Non-listed Wildlife Species

Habitat Removal and Fragmentation

The Auwahi Wind project is on a portion of the Ulupalakua Ranch that has been extensively grazed in the past and is currently used for cattle ranching and the existing vegetation includes many introduced species. Thus, vegetation removal would occur in an area that has previously been disturbed and contains no large contiguous blocks of intact or high quality habitat. Additionally, most of the non-listed wildlife species that use the analysis area are exotic. For these species, vegetation removal associated with the construction of the Auwahi Wind project represents a small amount of the habitat available to them within the analysis area. Therefore, vegetation removal would not result in a substantial local loss of wildlife habitat for non-listed species.

The Auwahi Wind project has been sited to avoid the Auwahi Forest Restoration Project, areas of native vegetation, and the Kanaio NAR. Thus, remnant habitats including dryland forest important to native wildlife species, including those protected by the MBTA, would be maintained under the Proposed Action.

The introduction and spread of invasive species can reduce habitat quality both within and adjacent to the analysis area by replacing native vegetation with exotic plant species that can favor wildlife species and compete with or prey on native wildlife. For example, in the Kanaio NAR native invertebrates have been heavily impacted by predation by an introduced ant species (Medeiros et al. 1993). Through the implementation of BMPs, described in Section 2.2.3.2, for invasive species prevention and control, such as the cleaning and inspection of equipment and vehicles and revegetation of disturbed areas with native species or pastureland vegetation, the introduction or spread of invasive species would be minimized. Therefore, construction of the Auwahi Wind project would not result in a substantial reduction in habitat quality for any wildlife species.

No additional habitat would be removed during operations Auwahi Wind project. Portions of the wind farm site and the generator-tie line corridor not needed for normal O&M would be revegetated and restored to approximate their pre-construction condition and function as wildlife habitat. In areas of taller vegetation along the generator-tie line corridor, vegetation would be trimmed to maintain fire and personnel safety clearance zones associated with the generator-tie line but would otherwise function as wildlife habitat.

On March 23, 2009, the USFWS received petitions from the Xerces Society to list seven species of Hawaiian yellow-faced bee as endangered under the ESA and designate associated critical habitat. The USFWS determined in May 2009, that an emergency listing was not warranted; however, on June 16, 2010, the USFWS released a 90-day finding under Section 4(b)(3)(A) of the ESA (75 CFR 34077-34088) in which it concluded that listing these species may be warranted. The USFWS conducted a 12-month status review of these species in accordance with Section 4(b)(3)(B) of the ESA and determined listing was warranted but precluded. Five of these seven species of Hawaiian yellow-faced bee (*Hylaeus facilis*, *H. longiceps*, *H. anthracinus*, *H. Hilaris*, and *H. assimulans*) may occur in the Auwahi Wind project analysis area although only one species observed. Their native food plants, such as iliahialoe, ohia, ilima, and naio, have been documented in and adjacent to the project, though the analysis area is dominated by non-native vegetation and does not contain dry forest or coastal habitat preferred by Hawaiian yellow-faced bees. However, individual Hawaiian yellow-faced bees could be negatively affected during construction directly, due to crushing or collision with construction equipment, if ground nests are crushed or vegetation used for nesting is removed, or if plants used for nectar and pollen collection are removed. They could also be indirectly impacted through increased habitat fragmentation due to road construction, increased risk of the invasive species impacts to habitat, and increased risk of adverse wildfire impacts.

Auwahi Wind anticipates the project-related impacts to yellow-faced bees under the Proposed Action can be avoided. Construction activities would not impact coastal strand or dryland forest habitat, with the exception of a small area within the generator-tie line corridor between the Kanaio NAR and the Auwahi Forest Restoration Project. Thus no intact areas of native habitat used by these species would be fragmented. Native nectar plants documented in the area of project disturbance would be avoided to the extent possible and any loss of habitat would be very minor (i.e., consisting of individual plants). As habitat loss is one of the bees' greatest threats, standard BMPs would be implemented to minimize the spread of invasive plants species and disturbed areas would be replanted with approved native or pasture grass species. Implementation of the Auwahi Wind project FMP (Appendix A of the HCP) would prevent fire from impacting native habitat potentially used by yellow-faced bees in the vicinity of the project. These measures would minimize the potential for project-related reductions in habitat suitability for yellow-faced bees. Further, the Auwahi Wind project's implementation of habitat restoration for the Blackburn's sphinx moth and Hawaiian hoary bat will offset the potential adverse project impacts to the Hawaiian yellow-faced bees by increasing the distribution and abundance of yellow-faced bee habitat. Through natural regeneration on this land which is in conservation easement for perpetuity, benefits from this mitigation should occur beyond the lifespan of the Proposed Action.

Direct Mortality

Non-listed avian species have the potential to collide with vehicles or equipment during construction. Mitigation measures including speed limits on project roads would be implemented to minimize the risk of collisions. Non-listed avian species also have the potential to collide with operating WTGs or other project structures such as the generator-tie line. At the existing Kaheawa I Wind Farm on Maui, as of August 2010, 13 fatalities of non-listed avian species were documented during the first 3.5 years of facility operations (Hufana, pers. comm., 2010). It is foreseeable that impacts would be less at the Auwahi Wind Project because there are fewer turbines than at the Kaheawa I wind farm because there are fewer WTGs. Post-construction fatality monitoring would be conducted within the wind farm site to assess potential impacts to non-listed and listed species as a result of operations of the Auwahi Wind project. Collisions with power lines or the met tower would be avoided by burying onsite collection lines, installing bird flight diverters on the generator-tie line (along the approximately 1.6 miles (1.0 km) portion identified as having the highest collision risk) and wind farm met-tower guy wires, and flagging wind farm met-tower guy wires. Therefore, with the expected low level of project-related mortality, no local or regional population-level effects are anticipated for any of these species.

Invertebrate species, given their limited mobility, are most likely to be killed or injured by construction equipment and vehicles. The grading of roads and turbine sites could potentially result in some fatalities of these species. Fatalities during construction would not reduce the viability of invertebrate population within the analysis area given the temporary nature of potential effects. Invertebrates could be injured or killed during project operations due to collisions with equipment and vehicles. However, given that onsite traffic would be infrequent in association with routine maintenance and onsite speed limits would be observed, the likelihood of project-related impacts to invertebrates would be low.

Noise and Disturbance

Construction-related activities, including installation of WTG and generator-tie line structures as well as construction of access roads (including blasting) and other project facilities, use of heavy equipment, and high levels of human activity around the construction sites would result in increased onsite noise and human presence that could disturb wildlife using the analysis area. However, given the temporary nature of the construction period, and the existing level of noise and human activity in the analysis area associated with ranching, construction of the Auwahi Wind project would not preclude wildlife from using the analysis area.

To a much lesser extent than during construction, project O&M activities would result in low levels of noise and disturbance at the wind farm site and along the generator-tie line from the WTGs and staff conducting regular operations activities. Given the temporary and localized nature of noise and disturbance, no long-term impacts to non-listed species breeding or foraging activities within the analysis area would be anticipated.

Hawaii State Species of Concern

Hawaiian Short-eared Owl

It is assumed that the Hawaiian short-eared owl could occur within the analysis area on occasion because one was documented during point count surveys. As noted in Section 3.7.2.1, they are associated with grasslands and shrublands and therefore likely use these habitats within the analysis area for foraging. Construction of the Auwahi Wind project would disturb a total of approximately 78.2 acres (31.6 ha) of grassland and shrubland habitat that could be potentially used for foraging. This comprises approximately 3.8 percent of the grassland and shrubland within the analysis area. Therefore, construction of the Auwahi Wind farm would not result in an appreciable loss of habitat for this species and at most would affect individual owls in the immediate vicinity of permanent project structures where no revegetation would occur.

Data from operating wind farms in North America suggest that short-eared owls are not generally susceptible to collisions with WTGs (Kingsley and Whittman 2007). At the existing Kaheawa I wind farm on Maui, short-eared owls have been observed flying low over the ground over open pastures and grasslands, well below the rotor swept area. As of August 2010, three fatalities of short-eared owls have been documented at the Kaheawa I site during 3.5 years of operation, including one along an access road, presumably due to a collision with a vehicle, and two due to collisions with WTGs (Hufana, pers. comm., 2010). Thus there is the potential that short-eared owls could collide with construction or maintenance vehicles while foraging, but the likelihood of this appears very low as only one individual was observed during surveys. Adherence to vehicle speed restrictions on project roads, minimizing nighttime activities, and flagging met tower guy wires would reduce this likelihood even further. In addition, post-construction monitoring would be conducted to assess effects to the short-eared owl.

Pacific Golden Plover

The Pacific golden plover has the potential to occur during the winter months in the analysis area, where they are likely to forage for insects in open habitat. Removal of vegetation during construction would result in a minor loss of habitat for this species; however, this is not expected to preclude the species from using the analysis area given that the habitat removed comprises a small amount of the available habitat.

It is possible that Pacific golden plovers could collide with the WTGs during periods of poor visibility. Similar species of night-migrating neotropical migrants have occasionally been killed in large numbers by collisions with lit communication towers if they become attracted to or disoriented by them (WWF 2006). Additionally, Auwahi Wind requested a FAA endorsement of a minimal lighting plan to reduce the likelihood of attracting or disorienting migrating birds. Therefore, the potential for impacts to the Pacific golden plover resulting from collisions with WTGs or other project structures is expected to be low. Post-construction monitoring would be conducted to assess project-related effects to this species.

MBTA-protected Species

MBTA-protected species would be exposed to noise and disturbance during construction. Noise and disturbance would also occur during operations in association with routine O&M activities at the wind farm site and along the generator-tie line. However, due to the temporary and localized nature of these impacts, no long-term disturbance of MBTA-protected species breeding or foraging activities within the analysis area would be anticipated.

MBTA-protected species that fly through the analysis area have the potential to collide with WTGs or other project structures. At the existing Kaheawa I Wind Farm on Maui, as of August, 2010, one fatality of an MBTA-protected species was documented during the first 3.5 years of facility operations (Hufana, pers. comm., 2010). Auwahi Wind requested an FAA endorsement of a minimal lighting plan to reduce the likelihood of attracting or disorienting birds.

Measures described in Section 2.2.3.2 will avoid and minimize impacts to MBTA-protected species to the extent possible. Auwahi Wind has committed to implementing a post-construction monitoring program to assess project-related impacts to avian species and would use the results of this monitoring to ensure that impacts to MBTA-protected species are avoided and minimized to the extent possible. Additionally, the HCP mitigation measures for the Hawaiian hoary bat, Hawaiian petrel, and Blackburn's sphinx moth (Section 2.2.3.2) that would protect and/or restore native habitats would also benefit migratory bird species.

ESA-listed Species

The four state and federally listed wildlife species have the potential to be affected by construction or operations of the Auwahi Wind project. Therefore, in compliance with Section 10 of the ESA and HRS § 195D-4(g), Auwahi Wind submitted the HCP, the subject of the Proposed Action, in association with its application for an ITP/ITL issued by the USFWS and DOFAW, respectively.

The issuance of the ITP under the Proposed Action requires establishing the number of individuals or amount of habitat impacted for each covered species authorized for incidental take during a defined period. An estimate of potential direct take for each of the covered species was developed based on survey data and associated risk of collision modeling efforts (seabirds); information on the potential occurrence of each species in the analysis area; input from the USFWS and DOFAW; and initial post-construction monitoring data from the operating Kaheawa I wind project. The risk of collision model incorporated passage rates of petrel-type targets and flight height data derived from the radar surveys, avoidance rates, and the proposed project layout. Indirect take, or the take of eggs or dependent young when a parent is killed, was also taken into account. Methods for determining indirect take for each species are described in detail in the HCP.

Potential direct and indirect construction and operations-related impacts to ESA-listed species and species under consideration for listing are described below. A proposed mitigation strategy for estimated take is presented in Section 2.2.3.2.

For the Hawaiian hoary bat and Hawaiian petrel, the species most likely to be affected by the Auwahi Wind project, a three-tiered approach to take and mitigation has been developed based on the best available scientific information. Each tier represents a level of take and associated compensatory mitigation measures. Reaching Tier 1 levels of take for a species initiates implementation of Tier 2 mitigation, and so on. For the Hawaiian goose and Blackburn's sphinx moth, the likelihood of project-related effects is low given the absence of the species from the analysis area (Hawaiian goose) or due to measures that would avoid or minimize take (moth). Thus, a maximum take limit has been established for the Hawaiian goose over the 25-year period of the HCP/ITP. The requested HCP term is 25 years to cover construction, operations, and potential decommissioning of the project. Direct impacts to Blackburn's sphinx moth are anticipated to be avoided, although it is recognized that some potential impacts could occur to habitat and would be mitigated.

Table 4.8-1 summarizes the requested take levels for each of the covered species. The following subsections describe the potential direct and indirect effects of the project on the covered species and the basis for the take estimates and requested authorizations under the ITP for each species.

Table 4.8-1. Requested ITP authorization for ESA-listed species under the Proposed Action.

Species	Requested Take Over the 25-year HCP Period
Hawaiian petrel	Tier 1: 19 adults; 7 chicks Tier 2: 32 adults; 12 chicks Tier 3: 64 adults; 23 chicks
Hawaiian hoary bat	Tier 1: 5 adults; 2 young Tier 2: 10 adults; 4 young Tier 3: 19 adults; 8 young
Hawaiian goose	5 adults
Blackburn's sphinx moth	6 acres

Hawaiian Hoary Bat

Direct Take

There are four potential sources of direct bat mortality associated with the Auwahi Wind project. The first is vehicle collisions. This source of mortality is considered negligible given the limited nighttime traffic expected at the wind farm site and low speed limits posted and strictly enforced on access roads. The second is associated with construction- and maintenance-related clearing or trimming of woody vegetation taller than 15 ft (4.5 m) during the bat breeding season. However, this source of potential mortality is negligible, as such vegetation only occurs along a short portion of the new generator-tie line, and Auwahi Wind will not remove or trim such vegetation during the April to August breeding season. The third is collisions with stationary (e.g., met tower, generation tie-lines) and near-stationary (e.g., crane booms) objects. These sources of mortality are also considered negligible given the general ability of bats to avoid colliding with stationary objects. The fourth, and relatively most likely, potential source of direct bat mortality, used as the basis for quantifying direct take here, is a collision or other negative interaction with an operational WTG.

Given the similarities in landscape features (e.g., slope, aspect) and the number of WTGs between KWP I and the Auwahi Wind project, it is reasonable to use the KWP I data to estimate potential direct take resulting from WTG interactions at the Auwahi Wind project. Acoustic monitoring surveys have indicated that bat activity is also low at KWP I; however, KWP I contains more forest habitat in the vicinity suitable for roosting. Therefore, bat use would be expected to be greater than at the project. Two fatalities have been observed at the KWP I site during approximately 5 years of operation (KWP 2010), which translates to an estimated bat mortality of 0.04 bat per WTG per year at KWP I after accounting for scavenger activity and searcher efficiency (SWCA Inc. 2010). Transferring the KWP I per WTG estimate for the 8-WTG Siemens array for the Auwahi Wind project results in an estimated direct bat mortality of 0.320 bat per year.

Indirect Take

The take of a bat during the breeding season may result in the indirect loss or take of a dependent offspring. Several variables are needed to assess both the potential for and magnitude of this indirect take: the proportion of take assumed to be adult, the proportion of the take that is assumed to be female as only female bats care for young, the proportion of the year that is the breeding period, the likelihood that the loss of a reproductively active female results in the loss of its offspring, and average reproductive success. Table 4.8-2 illustrates the indirect take calculation for bats. Life history data upon which the indirect take calculation is based are provided in the HCP. Taking these parameters into account, the estimated annual indirect bat mortality is 0.123 young per year.

Table 4.8-2. Calculation of indirect take for the Hawaiian hoary bat.

Component	Description/Rationale	Estimate
A. Annual Direct Take (bats/year)	Estimate annual direct take	0.320
B. Proportion of take that is adult	As a conservative estimate, it was assumed that all take would be of adult bats, despite the potential for newly volant young (i.e., young of the year) to pass through the project area during the fall.	1.00
C. Proportion of take that is female	Hawaiian hoary bats are assumed to have an adult sex ratio of 1:1 and no sex-based differential susceptibility to WTG interactions. Therefore, female bats should comprise 50 percent of total take.	0.50
D. Proportion of "year" that is breeding period (5 of 12 months)	Adult hoary bats potentially occur at the project throughout the year. However, as the breeding season only spans April through August (Menard 2001, cited in Cooper and Day 2009), it is only the loss of adult bats during this 5-month period that may result in the indirect loss of dependent young.	0.42
E. Proportion of taken breeding adults with dependent young	Until weaning, young of the year are completely dependent on the female for survival. Therefore, all female mortality during the breeding season results in the loss of her young.	1.00
F. Average offspring/pair	Data are limited, average reproductive success in terms of young/year based on Bogan (1972) and Koehler and Barclay (2000).	1.83
G. Annual Indirect Take (young/year)	Multiplying Lines A through F results in an indirect take estimate.	0.123

Total Take and Requested Authorized Take Level

Based on the assumptions and analysis above, the maximum estimated annual take resulting from construction and operation of the Auwahi Wind project is 0.320 adult bat per year and 0.123 young per year, or 0.443 bats per year combined. The expected risk and magnitude of bat collisions will be reduced below these estimates because the WTGs are expected to be curtailed (turned off) on a regular basis between 2300 hrs and 0600 hrs due to the low demand for power from MECO during this time period, and the WTG blades will not be spinning during these periods of night-time curtailment. This curtailment was not included in the estimate of take. Mitigation for these effects is described in Section 2.2.3.2.

A tiered approach was taken for determining the requested authorized take levels for the Hawaiian hoary bat. Given the limited bat habitat present within the project site and expected low levels of activity, the calculated maximum level of take is not expected to occur. There are no obvious biological breaking points to establish a tiered approach; therefore, the three tiers were created relative to the maximum estimated take. Tier 1 take level assumes that the average annual take would be less than 25 percent of estimated maximum values. The requested Tier 2 take levels assume that average annual take would be 50 percent of the estimated maximum values. The requested Tier 3 take levels assume maximum annual take over the life of the Auwahi Wind project. The take limits for each tier were derived by extrapolating the annual estimated take (0.080 adult per year for Tier 1, 0.160 adult per year for Tier 2, and 0.320 adult per year for Tier 3) over the 25-year HCP term and rounding up to the nearest whole number. Indirect take was calculated based on the adjusted number of adult fatalities. Thus predicted take is:

- Tier 1—2 adults and 1 young over the 25-year ITP term;
- Tier 2—4 adults and 2 young over the 25-year ITP term; and
- Tier 3—8 adults and 4 young over the 25-year ITP term.

In recognition of the uncertainty surrounding the prediction of take and the estimation of actual mortality (i.e., searcher and scavenger bias may be more extreme at the project relative to KWP), Auwahi Wind is requesting authorization of a higher than predicted take and will mitigate accordingly. These requested take authorizations are based on a maximum annual take of 0.74 bat per year, a value that is 2.3 times higher than the predicted maximum annual take. Thus take requested by Auwahi Wind is:

- Tier 1—5 adults and 2 young over the 25-year ITP term;
- Tier 2—10 adults and 4 young over the 25-year ITP term; and
- Tier 3—19 adults and 8 young over the 25-year ITP term.

Each tier represents the total take requested and take is not additive among levels. Actual take will be adjusted based on the post-construction fatality monitoring plan (Appendix D of the project HCP) according to observed searcher efficiency and carcass removal rates. Should the post-construction monitoring results indicate that take levels will exceed a given tier the mitigation for the next tier will be initiated.

Population level effects

Recent population estimates for Hawaiian hoary bat have ranged from several hundred to several thousand (Bonaccorso pers. comm. 2010; Menard 2001). Although the greatest overall numbers of this species are thought to occur on the islands of Hawaii and Kauai (Menard 2001), systematic monitoring has not been conducted on Maui to estimate the size of its local population. Therefore, it is difficult to assess the effect that take of Hawaiian hoary bat resulting from the proposed Project may have on the local population of this species. However, as the levels of bat activity are expected to be low onsite given the lack of roosting habitat, the identified tiered levels of take are relatively low; Tier 3 estimated take is less than a single individual per year, a level of annual mortality than can be sustained by most populations. The Hawaiian hoary bat forages for insects in open areas such as grasslands and shrublands, habitats which exist in the Project area but are not limiting on the landscape; roosting habitat does not occur within the Project area. The mitigation efforts proposed by Auwahi Wind, and described in Section 2.2.3.2, will restore a minimum of 155 acres of roosting habitat and 44 acres of foraging habitat, resulting in substantial increases in these habitat types relative to Project habitat impacts. Auwahi Wind has committed to a long-term mitigation effort that, among other goals, provides immediate protection for bat foraging and roosting habitat. Additionally, the mitigation efforts would reestablish naturally regenerating native forests on Maui. Auwahi Wind's contributions to and efforts in support of the mitigation efforts would create, protect, and enhance suitable habitat for Hawaiian hoary bats over the life of the Project. Further, research funding would contribute to knowledge of the species abundance and distribution which will improve the effectiveness of future management efforts. A net benefit to the species will be realized by these mitigation efforts in two ways: one, the projected replacement of 21 adult bats does not account for young produced by the adult bats using the restored and protected habitat; and, two, the protected habitat would continue to be used by adult bats and their offspring beyond the term of the ITP/ITL.

Hawaiian Petrel

Direct Take

Sources of direct mortality of petrels associated with construction and operation of the Auwahi Wind project include collisions with WTGs, met towers, construction cranes, and collection/generator-tie lines. Seabird and waterfowl species have been documented detecting and avoiding WTGs and other human-made structures (e.g., transmission lines) in low-light conditions (Winkleman 1995; Dirksen et al. 1998; Desholm and Kahlert 2005; Desholm et al. 2006; Tetra Tech 2008a). Petrels are adept at flying through forests to and from their nests during low-light conditions and variable weather conditions and may exhibit strong avoidance behaviors when approaching WTGs or other structures. Petrels have been observed exhibiting avoidance behaviors at communication towers on Lanai (Tetra Tech 2008a) by adjusting flight directions away from the tower or by approaching the tower and turning away from the structure to avoid it. Only three petrel fatalities have been reported at Kaheawa I wind farm during over 5 years of operations and monitoring (D. Greenlee, pers. comm., 2011). Therefore, it is reasonable to assume that (1) petrels have the behavioral and physical capabilities to avoid towers and project components, and (2) a high proportion of petrels would detect and avoid large structures. However, complete avoidance of risk to the Hawaiian petrel may not be possible. Auwahi Wind will minimize the risk of collision for petrels by performing construction during daylight as much as feasible and minimizing lighting during night-time construction; increasing visibility of the permanent met tower and generator-tie line to reduce collision risk; periodically curtailing WTG operations at night during periods of high wind; and minimizing onsite lighting during project operations to avoid attracting seabirds. A detailed list of avoidance and minimization measures is provided in Section 2.2.3.2.

The Haleakala Hawaiian petrel colony is located approximately 5 miles (8 km) northeast of the wind farm site, and petrels fly to sea to forage for food for their young during the breeding season. Therefore, potential direct impacts could occur to petrels due to collision with WTGs or other project facilities when flying to and from the colony. As Haleakala is an active petrel breeding colony, the potential for indirect take of petrels exists if an adult is killed while incubating an egg or rearing a chick. However, not all losses of an adult during the nesting season will result in the loss of that year's young because not all adults are successful breeders. During the spring season, a large number of non-breeding individuals (both adults and juveniles) may also be present on the island; these individuals typically exit the colony by late August (Warham 1990; Ainley et al. 1997; Simons and Hodges 1998).

Passage rates of petrels through the wind farm site, as determined by the fall 2006 and spring 2010 radar surveys, were used as the basis for estimating direct take due to collisions with WTGs, which are the most likely source of collision. A description of passage rates and risk of collision analysis (Hamer 2010b) is provided in the project HCP. As described above, evidence suggests that petrels are capable of high levels of avoidance of vertical structures (Cooper and Day 1998; Tetra Tech 2008a; KWP 2009 and 2010). In the context of wind energy facilities, avoidance rate is defined as the probability that an individual bird that nears the airspace of a WTG is able to avoid colliding with the turbine. A high level of WTG avoidance is supported by mortality data collected during Kaheawa I post-construction monitoring (KWP 2010), which suggest that the avoidance rate is at least 97 percent. Hamer (2010b) estimated annual direct take of Hawaiian petrels resulting from collision with the Siemens 3.0-MW WTGs at the Auwahi Wind project to range from 0.662 to 2.487 petrels per year, at avoidance rates of 99 and 95 percent, respectively (Table 4.8-3).

Table 4.8-3. Direct take estimates for Hawaiian petrel.

Avoidance Rate	95%	99%
Annual Direct Take from Siemens 3.0-MW Turbines[1/]	2.487	0.662
Annual Direct Take from Met Tower	0.040	0.040
Annual Direct Take from Generator-tie	0.100	0.100
Total Annual Direct Take	2.627	0.802

[1/] From Hamer Environmental 2010b

In addition to collisions with operational WTGs, petrels may also collide with met towers. For Kaheawa II, the avoidance rate for collisions with a met tower was estimated at 95 percent, resulting in an annual take estimate of 0.04 petrel per year per tower, which has been applied to the proposed project's single guyed-met tower (Table 4.8-3) (Cooper and Day 2009). The met tower would also be marked with flagging and bird diverters to increase visibility as was done at Kaheawa I. This potential take estimate may be an overestimate because after 3 years of monitoring six met towers on Lanai, no take of petrels has been documented (Standley, pers. comm., 2010). Given the limited time period during which cranes would be onsite (during only a portion of which they would be vertical or in operation), the potential for petrel-crane collisions is assumed to be negligible and is not further considered.

Although there is some potential for petrels to collide with the generator-tie line, based on discussions between Auwahi Wind, the USFWS, DOFAW and the Endangered Species Review Committee, the area identified as being of primary concern was the approximate 1.6-mile (2.6-km) segment of the generator-tie line that runs perpendicular to the ridge running south west of the Haleakala crater. This area would stand in starkest relief to the surrounding landscape and, as a result, should present the highest collision risk. The highest component of this line (i.e., top of pole) would be no higher than 60 ft (18 m) above ground level in this segment, with actual height dependent on terrain features. To minimize collision risk in this area, lines would be marked with bird diverters. Observations of petrels on Kauai (Day et al. in review, cited in Cooper and Day 2009) suggest that petrels are highly capable of avoiding transmission lines. As a result, take resulting from collisions with the generator-tie line is assumed to be very small (0.1 petrel per year, following Cooper and Day 2009; Table 4.8-3).

Collisions between construction and maintenance vehicles and healthy, free-flying petrels are highly unlikely due to the temporal disconnect between bird activity and construction activity periods; their probability would be further minimized by the implementation of strict speed limits (25 mph [40 kph] during daytime and 10 mph [16 kph] at night) on project roads. Project vehicles do have the potential to collide with petrels that have been injured by collisions with WTGs, met towers, or collection systems. Because these collisions involve birds already accounted for in the preceding calculations, no additional take estimates are warranted. In addition, an environmental monitor would be onsite during any periods of night construction to assist with any downed birds that may be attracted to the lights, thereby minimizing the potential for collisions with downed birds. Petrels could also be inadvertently trapped during predator control trapping; however, the likelihood of this occurring is very low and any captured birds would be rehabilitated and released.

Indirect Take

The incidental take of a petrel during the breeding season may result in the indirect loss or take of a dependent chick. Several variables are needed to assess both the potential for and magnitude of this indirect take: the proportion of take assumed to be adult, the proportion of the activity period (i.e., period during which adults are visiting the colony) during which adults may be expected to have eggs or chicks, the likelihood that a given adult is reproductively active, the likelihood that the loss of a reproductively active adult results in the loss of its chick, and average reproductive success (Table 4.8-4). Table 4.8-4 illustrates the indirect take calculation for petrels. Taking these parameters into account, the estimated annual indirect petrel mortality is 0.928 or 0.283 chicks per year, assuming 95 percent and 99 percent avoidance, respectively.

Table 4.8-4. Indirect take estimate for Hawaiian petrel.

Component	Rationale/Description	Avoidance Rate	
		95%	99%
A. Annual Direct Take (adults/year)	Annual direct take from Table 4.8-3	2.627	0.802
B. Proportion of take that is adult	Assumed that 100 percent of direct take was of adult birds because juveniles (i.e., non-breeders under the age of six) rarely visit the breeding colony during the breeding season (Simons and Hodges 1998).	1.00	1.00
C. Proportion of "year" that is breeding period (6 of 8 months)	Although adult birds may be present at the colony over an 8-month period (March through October), only six of these months represent the breeding period (Simons and Hodges 1998).	0.75	0.75
D. Proportion of adults that breed	The proportion of adults attending the breeding colony that attempt to breed in a given year (Simons and Hodges 1998).	0.89	0.89
E. Proportion of taken breeding adults with dependent young	The impact of the loss of a single parent on a dependent chick varies within the breeding season: During May to September, both parents are deemed critical to chick survival. During May-August, only 89 percent of adults are breeding (89	0.84	0.84

Table 4.8-4. Indirect take estimate for Hawaiian petrel.

Component	Rationale/Description	Avoidance Rate 95%	Avoidance Rate 99%
	percent breeding * 1 chick/pair * 100 percent parental contribution). By September, only reproductively active adults are present on the colony (100 percent breeding * 1 chick/pair * 100 percent parental contribution). In October, the chick is no longer dependent on both parents (100 percent breeding * 1 chick/pair * 50 percent parental contribution). The proportion of taken breeding adults with dependent young was calculated as: ((0.89*1*1*4 months) + (1.00*1*1*1 month) + (0.5*1*1*1 month))/6 months = 0.84.		
F. Average chicks/pair	Average reproductive success for petrels on Maui (Simons and Hodges 1998).	0.63	0.63
G. Annual Indirect Take (chicks/year)	Multiplying Lines A through F.	0.928	0.283

<u>Total Take and Requested ITP Authorization</u>

Combining the direct and indirect take estimates for each level of avoidance provides a range of total take of adults and juveniles associated with construction and operation of the Auwahi Wind project (Table 4.8-5).

A tiered approach was taken for determining the requested authorized take levels for the Hawaiian petrel. The tiered approach provides assurance that if actual take levels (as determined by post-construction fatality monitoring) are higher than anticipated, additional specific mitigation would automatically be triggered. The requested Tier 1 and Tier 3 levels were based on anticipated annual adjusted take levels assuming 99 percent and 95 percent avoidance, respectively (Table 4.8-5). Tier 2 was based on 50 percent of the Tier 3 (or maximum) take level. That is, the take limit for each tier is the modeled estimated annual take for adults and juveniles extrapolated over a 25-year time frame and then rounded up to the nearest whole number. Each tier represents the total take requested and is not additive among levels. Estimated annual take assuming an avoidance rate of 99 percent was deemed appropriate for Tier 1 based on observations of petrels consistently avoiding vertical structures (Tetra Tech 2008a) and the mortality data collected at KWP I (i.e., three fatalities observed in 5 years of monitoring; KWP 2010). Furthermore, the WTGs are expected to be curtailed (turned-off) on a regular basis between 2300 hrs and 0600 hrs due to the low demand for power from MECO during this time period. Since the WTG blades will not be spinning during these periods of night-time curtailment, and petrel mortality estimates were not reduced based on this curtailment, the expected risk of petrel collisions is conservative, given that this period of curtailment partially coincides with the dawn peak period of petrel activity. The following is the requested ITP authorization:

Table 4.8-5. Total take estimate for Hawaiian petrels.

Tier	Adults	Juveniles
99% avoidance		
Annual average	0.802	0.283
Over 25 years	20.050	7.075
95% avoidance		
Annual average	2.627	0.928
Over 25 years	65.675	23.200

- Tier 1—19 adults and 7 chicks over the 25-year ITP term;
- Tier 2—32 adults and 12 chicks over the 25-year ITP term; and
- Tier 3—64 adults and 23 chicks over the 25-year ITP term.

Population level effects

The population size of the Haleakala petrel colony is estimated at 475 to 650 breeding pairs (950-1300 breeding individuals; Simons and Hodges 1998) and is assumed currently to be stable (Greenlee pers comm.). The maximum projected take from the Project (Tier 3) is 64 adult petrels (Section 5.2.4) over 25 years or 2.6 adults per year, of which an estimated 89 percent (Simons and Hodges 1998) (60 birds) are breeders. The Project-related mortality of 60 breeding adult Hawaiian petrels would constitute the loss of approximately 4.6 to 6.3 percent of the Haleakala population of adult breeding Hawaiian petrels. Annual take of adults predicted at 99 percent (Tier 1) and 95 percent (Tier 3) avoidance represents an additive mortality equivalent to 0.08 and 0.27 percent of the low end of the population estimate, respectively. In order to assess the potential population-level effects of additive mortality, it is important to compare additive mortality and current population size on the same temporal scale; in this instance, because petrels reproduce annually, the correct comparison is between projected annual additive mortality of adults (i.e., predicted take) and annual estimates of adult population size (i.e., the assumption of a stable population implies an annual population of 950-1300 adults at Haleakala). The maximum projected annual take of adults represents an additive mortality equivalent to 0.27 percent of the low end of the population estimate. Therefore, even in the absence of mitigation, the maximum projected take should not have a population-level effect on the Haleakala petrel colony because stable populations can absorb low levels (i.e., < 1 percent of current population) of additive mortality. The mitigation measures that Auwahi Wind has committed to (Section 6.3) to offset Project-related take, will further ensure that no population-level effects will result from Project construction and operations.

The mitigation efforts proposed by Auwahi Wind (described in Section 2.2.3.2) seek to protect and enhance existing petrel colonies and to create and restore petrel habitat on Maui. Largely through the implementation of predator control measures, Auwahi Wind's mitigation strategy is projected to result in the replacement of individual adult petrels within 20 years of mitigation initiation that will offset (and likely exceed) potential take. Therefore, the overall numbers of Hawaiian petrels will not be reduced as a result of the project. The construction and operation of the project will not result in any habitat destruction or modification for the Hawaiian petrel. Therefore, the proposed mitigation efforts will result in the protection of breeding habitats in excess of project impacts.

Hawaiian Goose

Direct and Indirect Take

Hawaiian geese are known to occur on Maui but, as previously discussed, considered highly unlikely to fly over or visit the analysis area with much frequency. Therefore, the likelihood of collision with WTGs or other proposed project facilities such as the generator-tie line is considered extremely low. However, take was considered to be likely because introductions of the species may occur on Maui in the future.

Total Take and Population-Level Effects

Given the slight chance that a Hawaiian goose would fly across the Project area and collide with one of the WTGs, the generator-tie line, or a crane, only one level of take is estimated for the Hawaiian goose: adult Hawaiian geese over the 25-year ITP/ITL term. Mortality of 5 Hawaiian geese (an annual mortality of 0.20 geese/year) resulting from construction and operation of the Auwahi Wind project is unlikely to have population-level impacts to the Maui population over the 25-year period. The recovery plan for the Hawaiian goose (USFWS 2004) lists protection and management of habitat, predator control, research, establishment of additional populations, captive breeding, and outreach and education as recovery actions needed to address these limiting factors. Therefore, as described in Section 2.2.3.2, Auwahi Wind will contribute $25,000 to Haleakala National Park (Park) to build a rescue pen and predator fence to support egg and gosling (and adult) rescue at the Park. Hawaiian geese are particularly vulnerable to predation during nesting and before the goslings fledge and the goose population at the Park is subject to high predation of eggs and goslings by cats, rats, and mongooses. In addition, because of adverse weather conditions at the Park, many eggs and goslings are lost to inclement weather. Funds to support egg and gosling rescue at Haleakala National Park would help the Park better address these issues and is an action recommended by the Recovery Action Group. This management activity will contribute to increasing reproductive success of the Park goose population, and therefore will provide a net benefit to the species.

Blackburn's Sphinx Moth

Direct and Indirect Take

Blackburn's sphinx moth eggs and larvae were detected during field surveys in 2008 and 2011; the host plants verified to occur within the project footprint include the invasive tree tobacco and aiea (*Nothocestrum* sp.; native host plant located in the generator tie-line and wind farm site) (Montgomery 2008; David and Guinther 2011; Guinther and Montgomery 2011). The native adult food plants, maiapilo and moonflower (*Ipomea tubanoides*) were also documented near Papaka Road and within the wind farm site. The aiea will be fenced and avoided during construction and most of the maiapilo and moon flower will also be avoided during construction. The Auwahi Wind project is situated in a region where adjacent and nearby parcels of land support stands of the native aiea and where the Blackburn's sphinx moth is known to occur. Host plants in the remaining undeveloped portions of the analysis area would be unaffected by construction and operation of the Auwahi Wind project and would continue to provide habitat for the moth.

Auwahi Wind anticipates that direct impacts to Blackburn's sphinx moth and larvae can be avoided by having a qualified entomologist conduct the pre-construction surveys for moths and larvae according to the DOFAW- and USFWS-approved protocol. The survey involves assessing tree tobacco plants for the presence of Blackburn's sphinx moth eggs, larvae, or signs indicating the possibility of pupating larvae (e.g., chewed stems or other browsing). If none of these signs are present, entire young plants and the above-ground portion of the mature plants are removed. On more mature plants, signs of pupating larvae may be less visible and root disturbance may dislodge larvae which can remain in the ground around the host plant, typically within 33 ft (10 m), for up to a year. Thus, around these cut stems the protocol requires that a 33-ft (10-m) disturbance-free buffer be established to prevent disturbance to any pupating larvae. The plant roots can then be removed 90-days following the initial survey.

A wet season survey was conducted in March-April 2011 (i.e., approximately one year prior to the initiation of construction). Tree tobacco was inspected and those plants without evidence of eggs or larvae were removed. Those few plants with larvae were left in place. This effort removed the invasive host plants within the disturbance area, reducing potential impacts. Another survey will be conducted within the disturbance area 90 days prior to construction to remove tree tobacco with no signs, and relocate moths. By clearing the non-native host plants and relocating any remaining moths or larvae prior to construction, direct impacts to the Blackburn's sphinx moth will be avoided because construction activities will not remove plants containing eggs or larvae, or expose eggs or larvae in the immediate vicinity of construction activities to dust. Only four maiapilo plants were observed within the wind farm site and three individual plants along Papaka Road within or adjacent to the temporary area of disturbance.

In general, all life stages of Blackburn's sphinx moth generally remain on or in proximity to their host plants. The adults would most likely not fly high enough to occur within the rotor swept area of the WTGs because they tend to stay close to the host plants (Montgomery, pers. comm., 2011). The generator-tie line is located adjacent to the Kanaio NAR, one of two regional populations of the moth that are regarded as a possible source area for dispersing or colonizing moth adults. Given that known habitat occurs adjacent to the Auwahi Wind project and that the dispersal capabilities of the species include flights of up to 6.2 miles (10 km), there is the possibility that individual adult moths could wander into work areas as they disperse, and thus would be at risk of collision with construction equipment or vehicles; however, site speed limits of 25 mph (40 kph) or less will minimize this likelihood. Given that construction would be temporary and spatially localized, as equipment and vehicles would move along the corridor, it would result in negligible effects to the species.

Total Take and Population-Level Effects

There are no estimates of the numbers of Blackburn's sphinx moths that reside in or near the analysis area; therefore, it is not possible to quantify the exact number of individuals that could be taken by the removal of its host plant prior to construction of the Auwahi Wind project or harmed as a result of collision with construction equipment or vehicles. The pre-construction clearance survey to be conducted would identify the number of moths and any remaining larvae located near host plants, if any. These individuals will be removed and relocated to the same species of host plant, where possible, in the vicinity of where the moth or larvae were found but well outside of the project disturbance area. Therefore, it is anticipated that direct impact from clearing and construction activities would be avoided with the exception of an unknown number of eggs or larvae not observed or removed from the soil surrounding larval host plants during the pre-construction surveys.

Impacts to the Blackburn's sphinx moth were quantified by calculating the acreage of permanently disturbed vegetation, including areas where Blackburn's sphinx moth larval host or adult food plants have not been documented within the wind farm site and Papaka Road. The few moth-associated plants located by GPS in the field are shown in relation to the area of permanent disturbance (see Figure 5-1A, B, and C of the project HCP). Although very few plants would be affected by construction of the project, the area of permanent disturbance in the wind farm site and Papaka Road would be approximately 28 acres (11.3 ha).

The WTG pads, permanent access roads, the substation, O&M building, and generator-tie line structures would result in the permanent disturbance of vegetation within approximately 39 acres (16 ha). An additional 21 ac (8 ha) of mixed native forest and 60 ac (24 ha) of scrub/shrub vegetation will be impacted by temporary ground disturbance (Table 4.7-1). The WTG pads, substation, O&M building, and portions of the permanent access roads and generator-tie line will be developed within areas excluded from Blackburn's sphinx moth and plant critical habitat designation. Ulupalakua Ranch lands were excluded from the Blackburn's sphinx moth and plant critical habitat units because the ranch was managing portions of their lands for the conservation benefit of the moth and numerous other listed species. The benefits of exclusion outweighed the benefits of including these areas as critical habitat because there was a higher likelihood of beneficial conservation activities occurring without a critical habitat designation. Project-related temporary and permanent disturbance to areas within the project footprint, as well as impacts to this habitat resulting from the increased risks of invasive species and wildfire resulting from the project, will be offset by Auwahi Wind's mitigation projects. Auwahi Wind's proposed restoration of native forest on 155 ac (63 ha) to 195 ac (79 ha) of pasture (for Hawaiian hoary bat mitigation) and 6 ac (2 ha) of native forest restoration (for Blackburn's sphinx moth mitigation) will offset project impacts to the portions of critical habitat units excluded from designation as critical habitat on Ulupalakua Ranch. Routine O&M activities will have minimal impacts to vegetation.

Auwahi Wind has committed to avoidance strategies that will eliminate direct impacts to adults and above-ground larvae; an unquantifiable number of eggs or larvae not observed or removed from the soil surrounding larval host plants may be negatively affected during Project construction. Auwahi Wind has committed to habitat restoration efforts (Section 2.2.3.2) to replace presumed impacts to 28 acres of moth habitat, including replacement of disturbed areas were Blackburn's sphinx moth larval host or adult food plants have not been documented within the Project area and Papaka Road. The avoidance of direct impacts to adults and above-ground larvae and the replacement of habitat in excess of Project impacts will have a positive effect on moth populations.

4.8.2.3 Cumulative Impacts

Non-listed Wildlife

The CIAA for non-listed wildlife occurs in an area with very little development because it is located primarily within the Maui Coastal Land Trust Conservation Easement. Past ranching operations have resulted in decreased habitat quality because of the introduction and spread of nonnative invasive vegetation. However, ongoing restoration efforts in the Auwahi Forest Restoration Project are working to reestablish native vegetation. The only foreseeable project in the CIAA for non-listed wildlife, the Honuaula project, located west of the proposed interconnection substation, would result in a minor amount of additional habitat loss for non-native wildlife.

Mitigation measures proposed under the HCP would increase habitat for non-listed wildlife by restoring native forests on the Ulupalakua Ranch, and therefore would complement ongoing dryland forest restoration efforts. Furthermore, installation of mitigation fencing would preclude other more detrimental types of adverse effects associated with development from occurring (e.g., loss of habitat) and portions of the ranch would remain in agricultural conservation easement. This would result in an increase in connectivity with the Kula Forest Reserve. The Auwahi Wind project would make a minor contribution to a cumulative reduction of habitat for some non-listed wildlife species; however, most of the non-listed wildlife species occurring on the property are common and not native to Hawaii and generally tolerant of development. Additionally, none of these actions would result in a substantial loss of native vegetation. Therefore, cumulative effects to non-listed wildlife associated with habitat loss or fragmentation are expected to be minor.

The existing communication towers near the generator-tie line, the existing 69-kV transmission line, as well as the proposed 69-kV Kihei Transmission Line present a potential collision risk for non-listed avian species. Proposed mitigation fencing under the HCP would also pose the risk of collision but this would be minimized by using white polytape to increase fenceline visibility. The proposed wind turbines, met tower, and generator-tie line would contribute to this risk. As noted above, post-construction monitoring at the wind farm site and in the generator-tie line corridor would assess project-related effects to all species. Therefore, this risk would be managed to an acceptable level through avoidance and minimization measures.

Existing sources of noise and disturbance to wildlife in the CIAA include ongoing ranch operations and current use of roads, which would be expected to continue over the term of the HCP and during operation of the Auwahi Wind project. Implementation of the HCP as well as construction and operation of the Auwahi Wind project would contribute to short-term and long-term noise levels; however, it would not be expected to preclude non-listed wildlife from using the CIAA. Additionally, as noted above, protection and restoration of native ecosystems would ultimately benefit non-listed wildlife species. Therefore, the direct and indirect effects of the Proposed Action in combination with the projects described above would have negligible cumulative impact to non-listed species.

MBTA Species

Potential impacts to MBTA-protected avian species from past, present, and future actions in the CIAA would be similar to those described above for non-listed avian wildlife including past reductions in habitat quality or quantity associated with ongoing land uses on the Ulupalakua Ranch, collision risk due to the three existing communications towers along the generator-tie line, the existing transmission lines, and noise and disturbance due to ongoing ranch operations and use of existing roads. In contrast, the Auwahi Forest Restoration Project and Kahikinui Forest Project would have beneficial impacts to habitat for all bird species. Mitigation measures implemented under the HCP would benefit birds by restoring native Hawaiian ecosystems. Additionally, the design of the Auwahi Wind project includes the most current avoidance and minimization measures recommended by the USFWS and thereby would reduce potential impacts to MBTA species to the maximum extent possible. Therefore, the direct and indirect effects of the Proposed Action in combination with ongoing and foreseeable projects would make a minor contribution to cumulative effects to MBTA species.

Hawaiian Species of Concern

Ongoing use of roads within the CIAA and the three existing communications towers presents potential collision risks with the Hawaiian short-eared owl and Pacific golden plover. Construction of the Honuaula project would result in temporary noise and disturbance to these species. Implementation of the HCP would have no adverse effect on these species; however, mitigation activities involving the protection and restoration of native vegetation would improve their habitat quality. Use of the proposed access roads and construction and operation of the Auwahi Wind project would contribute to collision risk. However, measures including adhering to project speed limits and minimizing nighttime lighting would reduce the Auwahi Wind project's contribution to these effects. For this reason, no significant adverse cumulative impacts to the species' overall population are anticipated from the direct and indirect effects of the Proposed Action in combination with other projects.

ESA-listed Species

The CIAA for ESA-listed species encompasses other operating and proposed wind farms on Maui that specifically address, and could impact, the same population of species which are the focus of the HCP for the Auwahi Wind project. The CIAA also encompasses other recovery efforts that will benefit the Maui populations of the Covered Species. The following discussion addresses cumulative impacts under the Proposed Action to each Covered Species. Past, present, and foreseeable actions that overlap in space and time with the impacts of the Proposed Action on the Covered Species are identified in Table 4.1-2 and described below where appropriate.

At a broader scale the Auwahi Wind project is one of many projects that have the potential to impact the Covered Species on a range-wide basis. In addition to the projects listed in Table 4.1-2, approved wind projects in Hawaii include Kahuku Wind Power (Oahu) and Pakini Nui (Hawaii Island); other proposed wind projects include Kawailoa (Oahu), Na Pua Makani (Oahu), and Kauai Wind Power (Kauai). These projects also have the potential to result in incidental take of listed species and are implementing or developing HCPs. It is anticipated that due to the State's RPS objectives wind energy development in Hawaii will continue. Furthermore, rapid population growth and real estate development have occurred on the islands of Oahu, Maui, and Kauai which are expected to continue. Light disorientation, loss of nesting or roosting habitat, pesticide use, and increased mammal predation, impacts identified as threats to the Covered Species, may also increase in association with this development. It is assumed that future development projects will be conducted in compliance with all applicable local, state, and federal environmental regulations; however, projects involving the development of HCPs are among the few that will implement measures to offset take of listed species. Under the Federal ESA, HCPs are required to minimize and mitigate the effects of incidental take. In addition to these requirements, the State of Hawaii under HRS § 195D-4 requires that all HCPs, and actions designed therein, result in an overall net benefit to the threatened and endangered species they cover.

Hawaiian Hoary Bat

The Hawaiian hoary bat is listed as endangered. As described in Section 3.7.4.1, there remains much uncertainty related to the distribution, abundance, and range-wide trends of the Hawaiian hoary bat; therefore, it is difficult to assess the significance of individual projects or cumulative impacts to the Maui population as a whole. On Maui, past development and land use has resulted in the loss of roosting habitat through the removal of native forest. Ongoing impacts such as wildfire and development have the potential to result in further habitat loss.

The Auwahi Wind project has the potential to result in the incidental take of this species through collisions or other interactions with wind turbines, which will be mitigated for through a combination of habitat restoration and research. Incidental take also has the potential to occur in association with the proposed and operating wind farms on Maui (collisions) and with the proposed Honualula development project (removal of roosting habitat). The primary component of mitigation under the Kaheawa I HCP and the proposed Kaheawa II HCP are funding for bat research or a combination of forest restoration and research funding, respectively. Similar measures are assumed for the Honuaula HCP. Restoration efforts are expected to increase survival and reproductive success of bats commensurate with the authorized take levels such that a net benefit is achieved. Research will also provide a net benefit to the species by providing a greater understanding of its life history which will help direct future mitigation efforts. It is assumed that if mitigation measures outlined in these HCPs are implemented these project would not contribute to adverse cumulative effects to the Covered Species. Ongoing restoration efforts including the Auwahi Forest Restoration Project and the Kahikinui Forest Project will further benefit the Hawaiian hoary bat through creation and enhancement of roosting habitat. For these reasons, the Proposed Action in combination with ongoing and foreseeable projects would not result in significant adverse cumulative effects to the Hawaiian hoary bat.

Hawaiian Petrel

The Hawaiian petrel is listed as endangered. As described in Section 3.7.4.2, range-wide the species continues to be impacted by habitat degradation at breeding colonies due to feral ungulates, predation by introduced animals, and disorientation by nighttime lighting. Residential development is anticipated to continue on Maui in areas zoned for this use and has the potential to result in additional lighting impacts to petrels (grounding).

The Auwahi Wind project has the potential to result in the incidental take of this species through collisions with wind turbines, which will be mitigated for through protection and management of the petrel colony at the upper elevations of Kahikinui. Similar impacts have the potential to occur in association with the proposed and operating wind farms on Maui, the ATST project, existing and proposed transmission lines on Maui, and the existing communications towers near the generator-tie line corridor (Table 4.1-2). Mitigation under the Kaheawa I HCP, the ATST HCP, and proposed under the Kaheawa II HCP, consist of colony-based management on Maui, consisting of fencing and/or predator trapping to protect nesting seabirds and eradicate predators and potentially other colony enhancement measures. These measures are expected to increase adult and juvenile survival as well as overall colony productivity. Thus, mitigation under the Proposed Action as well as the other Maui HCPs would offset the requested take for each project and provide a net benefit to the species by producing a greater number of new birds than the authorized take limit. Ongoing petrel management in Haleakala National Park and that proposed under the LHWRP management plan for Kahikinui, which also includes petrel colony protection and predator control, would benefit the species. For these reasons, the Proposed Action in combination with other ongoing and foreseeable projects would not result in significant adverse cumulative effects to the Hawaiian petrel.

Hawaiian Goose

The Hawaiian goose is listed as endangered. As described in Section 3.7.4.3, range-wide this species continues to be impacted by habitat loss and predation. Ongoing development on Maui has the potential to decrease nesting and foraging habitat, as well as result in land conversions which may attract Hawaiian geese to areas where they may be more vulnerable to vehicle collisions or other adverse human interactions (Mitchell et al. 2005). All populations have been or are currently being supplemented by captive-bred birds and throughout the state there a number of reintroduction efforts being made under existing Safe Harbor Agreements (agreements authorizing take associated with voluntary management activities on private land to enhance, restore, or maintain habitat benefiting a listed species).

There is a very small chance that Hawaiian geese could fly through the Auwahi Wind project and collide with a project structure. This incidental take will be mitigated by contributing funds to conduct predator control or support egg and gosling rescue at Haleakala National Park. These efforts will contribute to increasing reproductive success of the Park Hawaiian goose population, and therefore will provide a net benefit to the species.

Other projects with Hawaiian goose collision potential include the existing communications towers near the generator-tie line corridor, existing and proposed transmission lines on Maui, and existing and proposed Maui wind projects (Table 4.1-2). Mitigation for incidental take under the Kaheawa I HCP, and proposed under the Kaheawa II HCP, consisting of funding for propagation and release of goslings and/or translocation of adults to a release facility (e.g., the Haleakala Ranch), will provide a net benefit to the species by in the form of an increase in the species' population. Ongoing Hawaiian goose management at Haleakala National Park and Haleakala Ranch, which are also intended to reverse the declining trend in the population, will contribute to these beneficial actions.

For these reasons, the Proposed Action, in combination with other ongoing and foreseeable projects would not result in significant adverse cumulative effects to the Hawaiian goose.

Blackburn's Sphinx Moth

The Blackburn's sphinx moth is listed as endangered. As described in Section 3.7.4.4, throughout its range, this species continues to be impacted by loss and degradation of habitat from urban and agricultural development, invasion by non-native plant species, wildfires, and cattle grazing. The Auwahi Wind project would result in the loss of disturbed habitat that contains host plants for this species, which will be mitigated for by contributing to dryland forest restoration efforts. This will provide a net benefit to the species through the creation of more habitat than would be removed. An HCP is currently being prepared for the Honuaula development project which will remove Blackburn's sphinx moth habitat; it is assumed that similar mitigation would be implemented. Auwahi Forest Restoration Project will also benefit the species through dryland forest restoration. For these reasons, the Proposed Action, in combination with other ongoing and foreseeable projects would not result in significant adverse cumulative effects to the Blackburn's sphinx moth.

4.8.2.4 Conclusion

Potential adverse impacts to wildlife associated with the Auwahi Wind project including minor, localized habitat removal; collision potential; and temporary disturbance would be avoided or minimized through measures identified in the HCP and listed in Chapter 2. These measures include construction timing considerations, pre-construction surveys, selection of project components, and micrositing considerations. HCP mitigation measures would benefit wildlife over the long-term through the protection (fencing) and/or enhancement (outplantings) of native ecosystems. Therefore, direct, indirect, and cumulative effects of implementing the Proposed Action on wildlife, given the avoidance, minimization, and mitigation measures proposed, would be minor for general wildlife species and negligible for the Covered Species due to the net benefit provided by species-specific mitigation.

4.8.3 Alternative 3 – Reduced Permit Term

4.8.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Under Alternative 3 Auwahi Wind would implement of all the same avoidance and minimization measures included in the HCP and described in Section 2.2.3.1, as under the Proposed Action. These measures would avoid and minimize impacts to the Covered Species as well as other wildlife species. Post-construction monitoring and implementation of the Wildlife Education and Incidental Reporting program under the HCP to document project-related impacts to all species would also occur under Alternative 3.

Alternative 3 would involve implementation of the same mitigation activities described for the Proposed Action, and thus ultimately would result in the same benefits to the Covered Species, as well as other native Hawaiian plants and wildlife, as discussed in detail above in Sections 2.2.3.2. Short-term construction-related impacts such as noise, disturbance, minor vegetation removal, and ground disturbance associated with mitigation at the Waihou and Kahikinui mitigation sites as described in 2.2.3.2 for the Proposed Action, would also occur under Alternative 3 but to a lesser extent with the reduced mitigation requirements. That is, under Alternative 3, less fencing would potentially be constructed at the Waihou Mitigation Area, and at Kahikinui, if fencing becomes a viable option in the future, resulting in shorter construction periods and reduced ground disturbance. Likewise, fewer years of predator control (trapping) would be required at the Kahikinui petrel colony, or at the colony in the ATST mitigation site, to achieve the net benefit to petrels. Based on the reduced Tier 3 take under Alternative 3, due to the 21 year operating period, 11 years of predator trapping would be required to achieve a net benefit to petrels, compared to 15 years under the Proposed Action (see Tables 6-5a and 6-5b of the HCP).

Under Alternative 3, the same measures to minimize adverse impacts to wildlife associated with HCP mitigation would be implemented as describe for the Proposed Action, such as implementing standard BMPs for reducing soil erosion and the introduction or spread of invasive species; minimizing the area of vegetation clearing; and avoiding the removal of potential trees during the pupping season (July 1 to August 15); and conducting pre-construction biological surveys along the proposed mitigation fencelines. All impacts associated with implementing Hawaiian goose and Blackburn's sphinx moth mitigation would be the same as described for the Proposed Action.

4.8.3.2 Potential Impacts of the Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 on wildlife would be the same as under the Proposed Action given that the same construction, operation, and decommissioning activities would occur. Impact would be minimized through implementation of the avoidance and minimization measures listed in Section 2.2.3.1. However, for Covered Species, authorized take levels would be less due to the reduced permit term. In calculating potential take all years associated with Auwahi Wind project construction, operation, and decommissioning were assumed to have an equal potential rate of take. Thus, potential take of Hawaiian petrels and Hawaiian hoary bats authorized under Alternative 3 was calculated by multiplying the annual rates of take (Tables 4.8-2 and 4.8-4 for bats and petrels, respectively) by 21 years rather than 25 years as under the Proposed Action. Note that for the Hawaiia hoary bat, a conservative annual rate of take was used to calculate requested take due to the uncertainty in predicting bat take levels (see Section 4.8 for additional discussion).Take of the Hawaiian goose and Blackburn's sphinx moth under Alternative 3 is the same as under the Proposed Action because these species have a low likelihood of occurring in the vicinity of the Auwahi Wind project (Hawaiian goose) or because impacts are associated with construction of the project (Blackburn's sphinx moth). Authorized take levels under Alternative 3 are presented in Table 4.8-6. Mitigation for these effects under Alternative 3 would be similar to that under the Proposed Action; however, required mitigation acreages for petrels and bats would be reduced due to the slightly lower total take levels (see Section 4.8.3.1 above for details).

Table 4.8-6. Requested ITP authorization for ESA-listed species under Alternative 3.

Species	Requested Take Over the 21-year HCP Period
Hawaiian petrel	Tier 1: 17 adults; 6 chicks
	Tier 2: 28 adults; 10 chicks
	Tier 3: 55 adults; 19 chicks
Hawaiian hoary bat	Tier 1: 4 adults; 2 young
	Tier 2: 8 adults; 3 young
	Tier 3: 16 adults; 6 young
Hawaiian goose	5 adults
Blackburn's sphinx moth	6 acres

4.8.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.8.3.4 Conclusion

Alternative 3 would involve the same voidance, minimization, and mitigation measures as the Proposed Action, though fewer mitigation acres for petrels and bats would be required due to the slightly lower take levels. Therefore, direct, indirect, and cumulative effects of implementing the Alternative 3 on wildlife, given the avoidance, minimization, and mitigation measures proposed, would be minor for general wildlife species and negligible for the Covered Species due to the net benefit provided by species-specific mitigation.

4.9 LAND USE

4.9.1 Alternative 1 – No Action Alternative

4.9.1.1 Potential Impacts of Alternative 1

No impacts to land use or inconsistency with land use plans and policies would occur under the No Action Alternative because the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be constructed or operated.

4.9.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Therefore, Alternative 1 would not contribute to cumulative impacts to land use.

4.9.1.3 Conclusion

Alternative 1 would have no effect on land use because no action would be undertaken.

4.9.2 Alternative 2 – Proposed Action

4.9.2.1 Potential Impacts of the Proposed HCP Conservation Measures

The Auwahi Forest Restoration Project and Waihou Mitigation Area are located on land owned by Ulupalakua Ranch. The Kahikinui Forest Project is located on a parcel owned by DHHL, which is also Conservation District (Resources Subzone) land. The measures to be implemented under the HCP are intended by Auwahi Wind to be consistent with existing land uses, plans, and policies. Hawaiian goose mitigation would occur on National Park Service Lands. All mitigation activities are designed to compensate for any project-related impacts to the Covered Species and are intended to complement ongoing conservation efforts.

4.9.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Existing Land Use – Impacts to land use during construction activities associated with Auwahi Wind project would include short-term disruption to ranching within the site. Cattle would likely not be grazing in the areas with active construction. Wind farm facilities are widely recognized as being a compatible use of land with active ranches and farmlands; operations of the wind farm would not inhibit continued ranching or farming activities. While not only maintaining active cattle ranching operations and preserving the livelihood of Ulupalakua Ranch's employees, operation of the Auwahi Wind project is expected to increase the efficiency and productivity of ranching operations through the use of new access roads within the wind farm site. Therefore, the construction and operation of the Auwahi Wind project is not expected to result in significant impacts to any existing or future land uses.

Policies and Land Use Plans – The activities that would be carried out by Auwahi Wind should the ITP be issued were determined to be consistent with all federal, state, and local environmental and land use plans and policies by Maui County with their approval of the Final EIS for the Auwahi Wind project (Tetra Tech 2011). Auwahi Wind project consistency with federal, state, and local regulations is discussed in detail Section 1.3.

4.9.2.3 Cumulative Impacts

Implementation of the HCP may require a conservation district use permit for activities proposed on State Conservation District land (Kahikinui); however, mitigation activities would be compliant with the designated land use and would complement ongoing management efforts in the Kahikinui Forest Project as well as in the adjacent ATST mitigation site and in Haleakala National Park. None of these activities would conflict with the designated uses of the land. Mitigation sites proposed on Ulupalakua Ranch (in the Waihou Mitigation Area) would become part of a long-term agricultural conservation easement, which would remove this acreage from the possibility of other future land uses. This easement would contribute to the overall acreage entered into easement by the Ulupalakua Ranch.

Construction and operation of the Auwahi Wind project would be in compliance with all existing land uses and plans. Existing land uses on the Ulupalakua Ranch would continue during project operation. It is assumed that compliance with land uses and plans required under the various permits and approvals for other foreseeable projects. Therefore, there would be no cumulative impact to land use associated with the direct and indirect effects of the Proposed Action in combination with other projects.

4.9.2.4 Conclusion

The Proposed Action would be consistent with existing land uses, plans, and policies. Implementation of HCP mitigation measures would have no impact on future land uses. Negligible, short-term adverse impacts to land use would occur during construction of the Auwahi Wind project due to temporary disruptions in ranching activity; no impacts would occur during operation. Therefore, direct, indirect, and cumulative effects of implementing the Proposed Action on land use would be negligible.

4.9.3 Alternative 3 – Reduced Permit Term

4.9.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with implementing the proposed HCP under Alternative 3 related to land use would be the same as under the Proposed Action.

4.9.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 related to land use would be the same as under the Proposed Action.

4.9.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.9.3.4 Conclusion

Impacts to land use under Alternative 3 would be the same as under the Proposed Action. These include negligible, short-term adverse impacts to land use would occur during construction of the

Auwahi Wind project due to temporary disruptions in ranching activity. Future land uses would not be impacted. Therefore, direct, indirect, and cumulative effects of implementing Alternative 3 on land use would be negligible.

4.10 TRANSPORTATION AND TRAFFIC

4.10.1 Alternative 1 – No Action Alternative

4.10.1.1 Potential Impacts of Alternative 1

No impacts to transportation and traffic are expected under the No Action Alternative because the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Therefore, under the No Action Alternative existing traffic conditions would be maintained.

4.10.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Traffic levels within the project area would continue as they are now and Alternative 1 would make no contribution to cumulative impacts to transportation and traffic.

4.10.1.3 Conclusion

Alternative 1 would have no effect on transportation and traffic because no action would be undertaken.

4.10.2 Alternative 2 – Proposed Action

4.10.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Fence materials (posts and wire) would be transported to the Waihou Mitigation Area by flatbed truck to the staging area, which will be identified prior to conducting work. It is assumed that no widening or improvements of the roads would be required before the fence is installed.

Predator trapping equipment may require the use of a helicopter for delivery to the Kahikinui mitigation site. Likewise, should predator-proof fencing become a viable option for Kahikinui in the future, fence materials and equipment would be delivered by truck along NPS and/or DHHL roads to a designated helicopter landing sight and then flown by helicopter to the fence corridor. To avoid impacts to petrels from fence installation activity, it is anticipated that helicopters would begin delivering materials to the staging areas between November and February when petrels would not be present in the Kahikinui Forest Project and therefore would not be exposed to helicopter noise. Post driving and fence installation would occur when petrels are off-island; however, minor activities that would not disturb petrels would occur throughout the rest of the year. Fence work would occur during daylight hours.

Implementation of the HCP would result in a very minor amount of traffic during fence retrofitting/installation and in association with predator control and periodic monitoring at the mitigation sites, Hawaiian goose reintroduction efforts at Haleakala National Park, and the wind farm site (post-construction fatality monitoring) over the term of the ITP. All predator control and monitoring activities would occur on foot when away from designated roads. Therefore, the HCP would have a negligible impact to traffic and transportation.

4.10.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Construction of the Auwahi Wind project would require increased use of the harbor, highways, and roadways along the construction access route. Major project components would most likely be shipped directly to Kahului. However, there is the possibility they would be transshipped through Honolulu Harbor. The transport, staging, and storage of the WTG components have the potential to impact both Honolulu and Kahului harbor facilities and operations in the short term. Early planning and continued coordination with HDOT Harbors Division-Honolulu and Maui District offices would serve to avoid or minimize traffic congestion and delays in the harbor. Delivery of equipment and construction traffic would not adversely impact operations of any of the four Maui airports because traffic would be limited to water and ground transportation.

To facilitate the transport of superloads, modifications of overhead transmission lines or traffic lights could be necessary along the construction access route. At nine locations identified along Upcountry Piilani Highway road improvements (to include horizontal realignment or vertical re-profiling) would be necessary to accommodate the transport of oversized and heavy equipment. Any temporary or permanent road modifications proposed by the construction contractor would be coordinated with and permitted by HDOT or DPW, as appropriate. A section of unimproved Papaka Road would be improved (potentially including horizontal realignments, vertical re-profiling, curve widening). All of these accommodations would be fully funded by Auwahi Wind.

A detailed estimate of daily construction traffic through the Wailea/Makena area, Kula area, and within the Auwahi wind farm site is provided in the Final EIS for the Auwahi Wind project and summarized here. These numbers represent the amount of estimated construction traffic for the 10-month construction period. The estimate assumes that concrete and aggregate would be trucked into the wind farm site (rather than produced or obtained onsite). Construction traffic through the Wailea/Makena area (Route A) would include 2 to 32 vehicle trips per day by regular construction vehicles (i.e., dump trucks and construction worker trucks) over the 10 month period plus an additional maximum of 40 round trips per day by concrete trucks during three of these months and 7 round trips per day for 8 days for superloads (not on the same day as concrete deliveries). Construction traffic through the Kula area (Route B) would include 5 to 84 vehicle trips per day by regular construction vehicles over the 10-month period plus an additional maximum of 40 round trips per day by concrete trucks during three of these months. No superloads would be transported along this route. The Auwahi wind farm site, including some intra-site trips, would receive a total of 6 to 144 vehicle trips per day over the 10-month period, plus a maximum of 40 round trips per day by concrete trucks during three of these months and 7 round trips per day for 8 days for superloads during this period.

The construction impacts associated with the Auwahi Wind project will be short-term and will result in a small increase in traffic relative to current traffic volumes. Approximately 60 percent of all construction vehicles would transit Kula Highway (Route B), 26 percent of vehicles would transit through Wailea and Makena (Route A), and the remaining 14 percent would only transit between the start of Papaka Road and the wind farm site. Approximately 71 percent of all project construction traffic would be from construction workers commuting to the project over the course of the 10-month construction period; this estimate also assumes that 25 percent of workers would use carpooling. The Kula Highway route (Route B) would be used by three-quarters of all construction worker vehicles, two-thirds of off-site dump trucks, and three-quarters of typical semi-trucks anticipated for construction of the Auwahi Wind project.

According to a recent study by ATA (2009), 940 vehicles travel through the intersection of Piilani Highway and Wailea Ike Drive during the morning peak traffic hour, and 1,213 vehicles travel during afternoon peak traffic hour. In comparison, the maximum volume of construction traffic for the Auwahi Wind project through the Wailea and Makena communities would peak at less than 150 round trips per day. Much of this traffic would occur during non-peak hours or weekends for a period of 3 months. In addition, a traffic management plan will be coordinated with the State of HDOT and Maui County Department of Public Works (DPW to further minimize any inconvenience to the public. Specific vehicle types (e.g., construction worker vehicles, concrete trucks, and dump trucks) and anticipated levels of activity associated with the Auwahi Wind project are provided in the Final EIS. Auwahi Wind will work with HDOT and Maui County DPW to fully analyze, inspect, and confirm the ability of the roads and culverts along the route to support the loads.

To minimize impacts to traffic, Auwahi Wind, or its construction contractor, will prepare a traffic management plan for the major transport activities and for road improvements that could cause traffic delays. The traffic management plan would identify measures to avoid hazards from the increased truck traffic and to minimize impact to traffic flow on local public roads and highways; include a public communications plan, include a plan for repair of damaged roads; describe the scheduling of superloads and deliveries during off-peak traffic hours; and describe the procedures to coordinate with HDOT and Maui County DPW. To further minimize traffic impacts, construction workers will be encouraged to carpool.

Additional impacts to motorists, pedestrians, and bicyclists include exposure to construction dust as well as temporary damage to roadways from construction equipment. Dust will be monitored and controlled with a watering truck. Any roads or infrastructure damaged from construction activities would be repaired and restored to existing conditions or better. Still or video photography will be used to document roadway conditions prior to the beginning of construction to ensure that roads are restored to preexisting conditions or better.

A gravel access road would be built along portions of the proposed generator-tie line, where needed due to terrain, following the existing field road as much as practicable. With the exceptions of short-term delays along the road, no traffic-related impacts are anticipated during construction.

Operations of the wind farm are not expected to require frequent use of the harbor to deliver replacement equipment over the operational lifetime of the project. In addition, based on the location of the known runways, the Auwahi Wind project would not result in an obstruction of airspace. In accordance with FAA regulations, a Notice of Proposed Construction was filed and accepted via the FAA web site and accepted on May 27, 2011 (See Appendix L of the Final EIS for the Auwahi Wind project). Therefore, O&M activities would have negligible effects on the harbor and would have no effect on airport infrastructure or services.

During the O&M phase, the number of regular daily trips to the wind farm site or accessing the generator-tie line is expected to be no more than five inbound and five outbound, as proportional to the number of permanent project staff, with occasional additional trips associated with infrequent maintenance activities. Papaka Road would not be used during operations, except for infrequent delivery of replacement equipment. Thus, deliveries to the wind farm site and other maintenance traffic would be infrequent and result in a negligible increase in traffic. Therefore, over the long-term vehicle traffic associated with the Auwahi Wind project is not anticipated to increase traffic volumes on roadways in the analysis area. Additionally, there would be long-term beneficial impacts to the transportation system in the analysis area because the project would improve some roads, such as smoothing out bumps in Upcountry Piilani Highway, and would provide Ulupalakua Ranch employees and private landowners along Papaka Road with improved access on the property.

A gravel access road would be built along portions of the generator-tie line, where needed due to terrain, following the existing field road as much as practicable.

4.10.2.3 Cumulative Impacts

Implementation of the HCP would have negligible impacts related to transportation and traffic. There would be a minor, temporary increase in traffic due to the increased number of vehicles accessing the mitigation sites during mitigation fence installation, but that occurs primarily over private lands. Monitoring activities associated with the mitigation sites and within the wind farm would also result in minor, localized increase in traffic over the term of the ITP; however, this would not disrupt existing traffic.

Construction of the Auwahi Wind project would result in short-term traffic impacts in association with improvements along the construction access route and with the transport of superloads. However, transportation of superloads that would disrupt traffic would require a permit from HDOT or DPW that is expected to take into account other traffic disruptions associated with increased traffic due to the KWP II wind farm and the Honuaula project, which plan to use portions of the same access route during construction, and the two foreseeable road improvement projects (Table 4.1-2). The short-term adverse traffic impacts associated with the Auwahi Wind project would be mitigated with a traffic management plan and transporting superloads during off-peak traffic times.

Delivery of equipment and other construction traffic will not adversely impact operations of any of the four Maui airports because traffic would primarily be limited to water and ground transportation. If helicopters would be required for delivery of trapping equipment or fence materials at the Kahikinui Forest Project, should fencing become a viable option at some point in the future, these trips would be short term and would not impact airport operations. Both the KWP II wind farm and the Auwahi Wind project may use Kahului Harbor concurrently for equipment shipments. Auwahi Wind would coordinate with HDOT Harbors Division-Honolulu and Maui District offices would serve to avoid or minimize traffic congestion and delays in the harbor. Therefore, the direct and indirect effects of the Proposed Action in combination with other projects would not result in adverse cumulative impacts associated with transportation and traffic.

4.10.2.4 Conclusion

The HCP would have a negligible impact on traffic and transportation due to the very minor amount of traffic that would occur in association with implementing mitigation measures. Construction of the Auwahi Wind project would result in short-term moderate increases in traffic association along the construction access route and congestion associated the transport of superloads. A traffic management plan will be implemented to mitigate these traffic and transportation infrastructure impacts, including repair of damaged roads, which would ultimately have a long-term beneficial impact due to road improvements. Therefore, direct, indirect, and cumulative effects of implementing the Proposed Action on transportation and traffic, when mitigated as proposed, would be minor.

4.10.3 Alternative 3 – Reduced Permit Term

4.10.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with implementing the proposed HCP under Alternative 3 related to traffic would be comparable to the Proposed Action. However, under Alternative 3 fewer years of predator control would be required at the Kahikinui mitigation site. If this option for petrel mitigation were selected, it would reduce the anticipated low amount of traffic (technicians accessing the site on NPS or DHHL roads) even further, resulting in 4 years during which there would be no HCP-related traffic. Traffic associated with implementing all other mitigation and monitoring activities under Alternative 3 would be the same as under the Proposed Action.

4.10.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Traffic and transportation impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 would be the same as under the Proposed Action.

4.10.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.10.3.4 Conclusion

Impacts to traffic and transportation under Alternative 3 would similar to those under the Proposed Action including moderate, short-term increases in traffic and congestion during construction; however, the traffic management plan would also be implemented under Alternative 3 to mitigate these effects. Therefore, direct, indirect, and cumulative effects of implementing Alternative 3 on transportation and traffic, when mitigated as proposed, would be minor.

4.11 VISUAL RESOURCES

4.11.1 Alternative 1 – No Action Alternative

4.11.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be built. There would be no impacts to visual resources. Improvements in aesthetic quality due to restoration of native vegetation would not occur. The existing visual landscape would persist in the current state subject to future land use changes and development.

4.11.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP and therefore the HCP would not be implemented and the Auwahi Wind project would not be constructed. Therefore, Alternative 1 would not contribute to cumulative impacts to visual resources.

4.11.1.3 Conclusion

Alternative 1 would have no effect on visual resources because no action would be undertaken.

4.11.2 Alternative 2 – Proposed Action

4.11.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Implementation of the proposed HCP is not expected to adversely affect visual resources in areas affected by restoration activities. Installation of ungulate -proof fencing at the Waihou Mitigation Area, and at the Kahikinui mitigation site should this option become viable in the future, the only physical structures proposed under the HCP, is consistent with current activities on Ulupalakua Ranch, in the vicinity of the Kahikinui Forest Project (DOFAW 2004, LHWRP 2006), and at the ATST mitigation site. The proposed retrofitted fence at the Waihou Mitigation Area would look similar to an existing ungulate-proof fence at the Ulupalakua Ranch shown in Figure 2-5. Visual impacts of the retrofitted fence at the Waihou Mitigation Area would be minor given that the Proposed Action involves modifying an existing fence.

Although ungulate fencing itself may detract from the scenic value in the immediate vicinity of the mitigation areas over the short-term, it is intended to aid in the reforestation. Additionally, outplanting of native vegetation at the Waihou Mitigation Area as well as Auwahi Forest Restoration Project would ultimately restore the scenic character of the native Hawaiian ecosystem. Other mitigation measures proposed under the HCP would have no impact to visual resources.

Should installation of a predator-proof fence at Kahikinui become a viable option in the future, it could have minor visual impacts. Due to the location of the mitigation site downslope from the rim of the crater it would likely not be visible from Haleakala National Park or most of the leeward slope of Haleakala.

4.11.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

A visual analysis was performed to evaluate the degree of impact of the Auwahi Wind project on sensitive viewpoints. The steps in the process used to assess potential visual impacts included determining (1) the visibility of Auwahi Wind project facilities throughout the study area using viewshed mapping, (2) the existing visual quality at key viewpoints, and (3) the degree of change to the existing visual quality at those viewpoints from the presence of the Auwahi Wind project facilities. The WTGs and proposed generator-tie line are the dominant visual elements of the Auwahi Wind project and were the focus of the visual analysis. A Visual Analysis Report for the Auwahi Wind project is included as Appendix I of the Auwahi Wind project EIS which describes the visual analysis methods in detail.

Key observation points (KOPs) were selected based on the viewshed mapping and a field investigation to identify sensitive visual and aesthetic resources that may have views of the Auwahi Wind project facilities.

- KOP 1—Upcountry Piilani Highway traveling east at Kanaio NAR, view oriented east toward the proposed generator-tie line crossing of Upcountry Piilani Highway;
- KOP 2—Upcountry Piilani Highway traveling west, view oriented south-southwest toward the proposed wind farm site;
- KOP 3a—Kula Highway traveling north, view oriented north-northwest toward the proposed generator-tie line; and
- KOP 3b—Kula Highway traveling north, view oriented north-northeast toward the proposed generator-tie line.

The location of each KOP and photo renderings of the Auwahi Wind project as seen from these KOPs are provided in the Final EIS for the Auwahi Wind project.

Visual impacts during construction would be expected to be minor and short-term. Dust could be temporarily generated during site clearing and grading activities and the movement of heavy vehicles and equipment along local roads. To minimize visual impacts during construction, Auwahi Wind will keep construction time to a minimum, remove construction debris, and locate construction staging and storage areas away from adjacent local roads.

The terrain-based viewshed analysis indicates that the WTGs would be visible mainly from areas east of the Ahihi-Kinau NAR to the Haleakala National Park ridgeline, and immediately around wind farm site. Other likely areas of high visibility (i.e., all 8 WTGs visible) are generally limited to the area of the South Maui coastline to the west of the site and along the Hoapili trail to the south of the site. With a few areas of exception, as you move away from the site, if a single WTG is visible, then nearly all of the WTGs will be visible. The topography on this part of Maui is very favorable to restricting the view of the turbines to areas immediately surrounding the site, or of steadily increasing elevation away from the site. The Haleakala volcano forms a natural, rim-like, enclosure around the analysis area to the north, northeast, and east, effectively blocking the project from sight past the ridgeline. Similarly, but not as abruptly, the topography of the landscape to the west and northwest of the site also blocks visibility of the WTGs beyond approximately 6 miles (10 km).

Along the generator-tie line that areas of high visibility are scattered throughout the southwestern portion of the island of Maui. This analysis is conservative and does not account for vegetation and local infrastructure that would obstruct the visibility of the generator-tie line and poles more so than the WTGs because they are substantially shorter than the WTGs (60 ft [18.2 m] versus 431 ft [130.5 m]).

Views of the WTGs and generator-tie line from the KOPs would all be middleground views (between 0.5 and 3.5 miles [0.8 kilometer to 5.6 km]). The WTGs create a vertical contrast with the horizontal landscape sloping downward toward the horizon of the open ocean. Because the scale of the WTGs is diminished sufficiently at this middleground viewing distance, the WTGs are prominent but they do not dominate the other elements of the scene. The proposed generator-tie line would be generally screened by the topography and vegetation and would not interfere with the existing view because the existing transmission line is close to the highway right-of-way near the Auwahi Wind project.

Although limited, the Auwahi Wind project would impact visual resources in nearby areas. Views from Upcountry Piilani Highway would be temporary as travelers pass through this area of the highway. The portion of the highway with visibility of the Auwahi Wind project is limited to areas near the wind farm site and the generator-tie line crossings at Upcountry Piilani Highway. The topography is a limiting factor in visibility along Piilani highway, effectively screening visibility of the WTGs and generator-tie line to an eastbound traveler from approximately 3 miles (5 km) west of the site. For a westbound traveler along Piilani highway there are more locations where the WTGs will be visible, primarily within 5 miles (8 km) of the site but also potentially in locations 24 km (15 miles) west of the site; provided a perfect line of sight is afforded. Views from the Kanaio NAR would be largely screened by vegetation; and the most sensitive views from the southern coastline would be oriented south toward the ocean and way from the Auwahi Wind project. Impacts to these resources were deemed less than significant by Maui County in their approval of the Final EIS for the Auwahi Wind project (Tetra Tech 2011), because the wind farm site would not substantially degrade the foreground character of the landscape; nor would it cause substantial dominant visual change. Further, the proposed Project would not contribute to air pollution; rather, energy derived from its operation would displace energy generated by the burning of fossil fuels that emit GHG. As a result, the impact to visual and aesthetic quality caused by the proposed Project has been minimized to the extent possible.

To reduce visual impacts associated with the Auwahi Wind project, Auwahi Wind would oriented the WTGs in a string to improve aesthetics by providing a more uniform looking development.; place much of the project's electrical collection system underground; use a low-reflectivity finish for substation equipment to minimize its visibility; and use dull gray porcelain insulators to reduce insulator visibility. As a result, the Auwahi Wind project was deemed by Maui County to have less than significant impacts to visual and aesthetic quality. To help mitigate impacts to nighttime views, WTG lighting (aviation warning lighting) would be kept to the minimum recommended by the FAA guidelines (FAA 2007) and allow nighttime lighting of perimeter WTGs only, at a maximum spacing of 0.8 kilometer (0.5 mile). Synchronized, medium–intensity, pulsing red strobe lights will be used at night, rather than white strobes or steady burning red lights. While complying with FAA lighting regulations, Auwahi Wind will seek to minimize the number of WTGs that must be equipped with lights.

4.11.2.3 Cumulative Impacts

Cumulative impacts associated with visual resources would generally occur where visibility of mitigation fencing or the Auwahi Wind project facilities are added to other dominant visual structures, such as other wind energy projects, existing transmission lines, and other tall structures or development areas. Visual resources would be adversely impacted over the short term by implementation of the HCP due to the long-term presence of mitigation fencing on the Ulupalakua Ranch (Waihou Mitigation Area), and within the Kahikinui Forest Project if fencing were to become a viable option in the future. However, these impacts would be minor given that they are consistent with existing fencing on the ranch and existing and proposed fencing in and adjacent to the Kahikinui Forest Project, including at the ATST mitigation site and Haleakala National Park. Implementation of the HCP would result in an increase in the scenic value of all of the mitigation areas over the long- term due to the restoration of native vegetation.

The WTGs and generator-tie line would be new structures added to the visible landscape, which would alter existing views to varying degrees. The middle ground view would be primarily impacted with key view points from Upcountry Piilani Highway, the Kanaio NAR, and along the coast. Other visible structures in the CIAA include the existing transmission line that connects with the Wailea substation, two communications towers, the small civil defense communication tower, and various water tanks on the Ulupalakua Ranch. These structures would be visible intermittently and generally from middle to background distances from roads in the vicinity of the generator-tie line corridor. There are no existing wind energy projects or publicly proposed projects that would be visible simultaneously with the proposed Project. Therefore, cumulative impacts associated with the direct and indirect effects of the Proposed Action in combination with existing structures would be less than significant.

4.11.2.4 Conclusion

Fences installed or retrofitted under the HCP would be consistent with existing fencing and, therefore, visual impacts would be minor. Over the long-term implementation of the HCP would increase the scenic value of the mitigation areas due to the restoration of native vegetation. Adverse visual impacts during construction of the wind farm would be minor and short-term. The Auwahi Wind project would be visible to travelers passing by the wind farm site along Upcountry Piilani Highway, resulting in moderate changes to the visual character of the area; views from other viewpoints would be largely screened by vegetation, and the most sensitive views from the southern coastline would be oriented south toward the ocean and way from the Auwahi Wind project. Implementation of design and lighting measures would mitigate any aesthetic impacts. Therefore, direct, indirect, and cumulative effects of implementing the Proposed Action on visual resources, when minimized and mitigated as proposed, would be minor.

4.11.3 Alternative 3 – Reduced Permit Term

4.11.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with implementing the proposed HCP under Alternative 3 with respect to visual resources would be the same as under the Proposed Action.

4.11.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 with respect to visual resources would be the same as under the Proposed Action.

4.11.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.11.3.4 Conclusion

Impacts to visual resource under Alternative 3 would be the same as under the Proposed Action. Restoration of native ecosystems under the HCP would benefit visual resources over the long term. Design and lighting measures to mitigate aesthetic impacts would also be implemented under Alternative 3. Therefore, direct, indirect, and cumulative effects of implementing Alternative 3 on visual resources, when minimized and mitigated as proposed, would be minor.

4.12 AIR QUALITY

4.12.1 Alternative 1 – No Action

4.12.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. The No Action Alternative would avoid all air quality and GHG emissions associated with construction and operations. However, the No Action Alternative also would eliminate the long-term displacement of GHG emissions associated with alternative fossil fuel power generation systems.

4.12.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Air quality on Maui would remain high, but over the long-term there would be no beneficial impacts to air quality associated with reforestation efforts under the HCP, which would reduce the potential for wind erosion, or associated with the reduction in GHG emissions associated with wind farm operation. Therefore, Alternative 1 would not contribute to cumulative impacts to air quality.

4.12.1.3 Conclusion

Alternative 1 would have no effect on air quality because no action would be undertaken.

4.12.2 Alternative 2 – Proposed Action

4.12.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Implementation of the proposed HCP is not expected to affect air quality because none of the measures in the HCP require substantial amounts of earthwork or use of fossil-fueled equipment. A minor amount of fugitive dust and GHG emissions would occur due to vehicle (typically light trucks) and equipment use associated with mitigation activities and routine monitoring at the wind farm site and mitigation sites. Therefore, emissions associated with the implementation of the HCP would be temporary and infrequent and would not be expected to cause adverse effects to air quality or other sensitive resources. Over the long term, reforestation activities at the mitigation sites would reduce the tendency for wind erosion and consequently dust entrainment.

4.12.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Construction of the Auwahi Wind project would require the operation of heavy equipment and construction vehicles for various activities including construction of access roads, excavation and pouring of foundations, installation of buried and aboveground electrical interconnects, and the erection of WTG components. In addition, there would be additional round-trip vehicle traffic associated with construction worker commutes and heavy trucks delivering construction materials and facility components. Construction equipment and construction-related vehicle traffic would be a source of GHG emissions, primarily from combustion of engine fuel. The major GHGs for fuel combustion sources are carbon dioxide, methane, and nitrous oxide. A summary of GHG emissions from construction of the Auwahi Wind project are provided in Section 3.12 of the Final EIS (Tetra Tech 2011). While there are no state or federal impact significance thresholds for GHG emissions, EPA requires air permits for stationary sources that emit more than 75,000 tons/year (68,039 metric tonnes/year) carbon dioxide equivalents (CO_2e). The EPA permit threshold provides a general indication that GHG emissions from construction of the Auwahi Wind project would not be a significant impact. While emissions from onsite construction activities would be localized in one area, emissions from construction-related traffic would be spread over relatively long roadway corridors. Given that the anticipated quantities of onsite construction emissions are low; that sources construction emissions would be temporary and dispersed throughout the analysis area; that the trade winds have a dispersing effect; and that Hawaii air quality is currently in attainment for all criteria pollutants, it is anticipated that the construction of the Auwahi Wind project would be in compliance with all state of Hawaii and federal ambient air quality standards. The length of the roadway corridors over which traffic-related emissions would be distributed likewise indicates that there would be no localized violations of federal or state ambient air quality standards along construction traffic corridors. Consequently, construction of the Auwahi Wind project would not create significant air quality impacts.

Facility operations would be a small source of criteria pollutant and GHG emissions associated with onsite service vehicle use at the wind farm site and periodic facility inspections or maintenance activities at the generator-tie line and interconnection substation sites. In addition, leaks of insulating gas from transformers and switchgear at the interconnection substation could be sources of sulfur hexafluoride emissions (a very strong GHG). Given the low voltages of the generator-tie lines from this substation, only very small quantities of sulfur hexafluoride would be expected.

Operation of the Auwahi Wind project would provide long-term beneficial impacts on regional air quality. Power generation on Maui is derived from a mix of sources, most of which produce GHG emissions (DBEDT 2009). Table 4.12-1 summarizes the GHG emission rates for the existing mix of power sources on Maui. The analysis is based on data from DBEDT (2009), California Air Resources Board (2008), and U.S. Energy Information Agency 2010a,b. Based on the 2008 mix of power sources on Maui, each megawatt-hour of power generated by the Auwahi Wind project would displace 1,954 pounds (886 kg) of GHG emissions (CO_2e) annually that would otherwise be produced by alternative power sources. This assumes that all of the displaced generation would be from fossil fuel and biomass sources rather than other renewable generation. While the overall

Table 4.12-1. Summary of greenhouse gas emission rate for Maui power generation.

Fuel Source	Percent of Power Generation	Greenhouse Gas Emissions, Pounds per Megawatt-Hour of Power			
		CO_2	CH_4	N_2O	GWP, CO_2e
Coal	5.0	2,167	0.230	0.034	2,183
Petroleum	78.3	1,896	0.072	0.014	1,902
Biomass	7.8	2,277	0.728	0.097	2,324
Hydroelectric	1.0	0	0	0	0
Solar	0.1	0	0	0	0
Wind	7.7	0	0	0	0
Average (Fossil and Biomass)	91.2	1,944	0.137	0.023	1,954
Total	100.0	1,772	0.125	0.021	1,781

CH_4 = methane, GWP multiplier = 25
N_2O = nitrous oxide, GWP multiplier = 298
CO_2 = carbon dioxide, GWP multiplier = 1
CO_2e = carbon dioxide equivalents
GWP = global warming potential in carbon dioxide equivalents based on IPCC (2007)

power generation from the Auwahi Wind project would vary from year to year, each hour of full power generation would effectively displace about 20.5 U.S. tons (18.6 metric tonnes) of GHG emissions annually that would otherwise be produced by alternative fossil fuel and biomass power sources. Consequently, 65 hours of full power production from the wind farm would offset all of the GHG emissions generated during construction. While the overall power generation from the Auwahi Wind project would vary from year to year, each hour of full power generation could displace more than 76,694 U.S. tons (69,575 metric tonnes) of GHG emissions per year.

4.12.2.3 Cumulative Impacts

Air quality on Maui is high primarily because of consistent trade winds and limited emission sources. Implementation of the HCP would have only a minor short-term adverse impact to air quality. Impacts would be limited to temporary GHG emissions from construction equipment, crew and delivery vehicles, and helicopters at each of the mitigation sites. Vehicles would also generate fugitive dust. Likewise construction of the Auwahi Wind project would result in temporary GHG emissions, but would be in compliance with federal and state ambient air quality standards.

None of the foreseeable development projects coincide with the CIAA for climate and air quality; however, ongoing and proposed restoration work at Kahikinui, the ATST petrel mitigation site, and the Auwahi Forest Restoration Project may overlap. Emissions associated with these projects would also be minor and short term. Therefore, the direct and indirect effects of the Proposed Action in combination with these ongoing and foreseeable restoration projects would not result in adverse cumulative impacts to regional air quality.

Over the long term, operation of the Auwahi Wind project would result in beneficial impacts to air quality through the reduction in fossil fuel consumption and subsequent reduction in GHG emissions. The other operating wind projects on Maui would have similar beneficial impacts to air quality. Therefore, taken together these projects would result in a beneficial cumulative effect to this resource.

4.12.2.4 Conclusion

Implementation of the HCP and construction of the Auwahi Wind project would result in minor, short-term adverse impacts to air quality in association with vehicle emissions and dust. Over the long-term, the operation of the wind farm would result in a beneficial impact to air quality through the reduction in fossil fuel consumption. Therefore, direct, indirect, and cumulative effects of implementing the Proposed Action on air quality would be minor.

4.12.3 Alternative 3 – Reduced Permit Term

4.12.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with the implementation of the proposed HCP under Alternative 3 related to air quality would be the same as under the Proposed Action, but for shorter duration due to the reduced operating period.

4.12.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 related to air quality would be the same as under the Proposed Action. However, the long term beneficial impacts resulting from reduced fossil fuel consumption would be reduced due to the shorter operating period.

4.12.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action; however, the long term beneficial impacs resulting from fossil fuel consumption would be reduced due to the shorter operating period.

4.12.3.4 Conclusion

Impacts to air quality under Alternative 3 would be the same as under the Proposed Action. Minor, short-term reductions in airy quality would occur in association with vehicle emissions and dust. Over the long-term, the operation of the wind farm would result in a beneficial impact to air quality through the reduction in fossil fuel consumption. Therefore, direct, indirect, and cumulative effects of implementing Alternative 3 on air quality would be minor.

4.13 NOISE

4.13.1 Alternative 1 – No Action

4.13.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. No construction- or operations-related noise would be generated. Existing sound levels from local traffic and activities typical of the area would continue.

4.13.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Therefore, Alternative 1 would not contribute to cumulative impacts to noise.

4.13.1.3 Conclusion

Alternative 1 would have no effect on noise because no action would be undertaken.

4.13.2 Alternative 2 – Proposed Action

4.13.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Any noise associated with implementation of the proposed HCP would be temporary and short-term in duration. Noise-generating activity would include fence post pounding and/or vehicles (flat-bed and pick-up trucks or similar) driving in the vicinity of the mitigation sites. Traffic noise is categorized into two categories: (1) the noise that would occur during the initial temporary traffic related to fence installation; and (2) minor ongoing traffic from monitoring/maintenance staff and contractors. Vehicles accessing the Waihou Mitigation Area and Auwahi Forest Restoration Project site would use existing ranch roads. Vehicles accessing the Kahikinui Forest Project, the ATST mitigation site, and Haleakala National Park would use NPS or DHHL roads. Trapping equipment delivery and fence retrofitting and installation would elevate noise levels during short periods when helicopters are required (Kahikinui only). If necessary, Auwahi Wind and/or the fencing contractor would obtain a permit per Title 11, Chapter 46, HAR (Community Noise Control) prior to conducting work. Additionally, prior to conducting work, Auwahi Wind would coordinate with the HDOH as needed to determine if additional conditions or noise mitigation measures are needed based on the final plan, location, and timing of fencing activities. None of the other mitigation measures would result in elevated noise levels. Noise generated during mitigation activities associated with the HCP would not occur at night and is not expected to exceed permissible sound levels as described in Table 3.12-1.

4.13.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Wind Farm Site Construction – Construction of the Auwahi Wind project would be conducted in phases. It is likely that the WTGs would be erected in small groupings. Each grouping may undergo testing and commissioning prior to commencement of full commercial operation. Other construction activities include those for the supporting infrastructure including the O&M building and generator-tie line. The construction phase may cause short-term but unavoidable noise impacts depending on the activity and the distance to receiver. The sound levels from construction vary significantly depending on several factors such as the type and age of equipment, the specific equipment manufacturer and model, the operations performed, and the overall condition of the equipment and exhaust system mufflers.

Civil and electrical infrastructure constructed as part of the wind farm site underground includes WTG foundations and electrical collector cables. Several methods may be used to excavate openings to install these infrastructure components including standard excavators, bulldozers, and hydraulic hammers. Where in situ rock engineering properties do not allow for efficient ripping and/or other bulk removal methods, blasting may be required. The blasting would be conducted by drilling pilot holes at or slightly below the required excavation depths and charging the holes with explosives. After the charges are set, the blast area would be covered with mats to control airborne material and the charge will be ignited. Following the blasting, the material would be excavated with the standard excavator to the required depth. Blasting may only be required on occasion during the early stages of construction and therefore have a limited noise impact.

Sounds generated by construction would likely require a permit from the HDOH to allow the operation of construction equipment that exceeds the maximum permissible level at property boundaries. While the permit and permitting procedures would not limit the generated sound level, time restrictions may be placed on periods when the loudest construction activities are likely to occur, i.e., between 7:00 a.m. and 6:00 p.m., Monday through Friday, and between 9:00 a.m. and 6:00 p.m. on Saturday. The HDOH would require reasonable and standard practices be employed to minimize the impact of noise from construction. Provisions to conduct noise monitoring and community meetings may also be required but would likely be deemed unnecessary given the remote location. Auwahi Wind would proactively work with the surrounding community and attempt to resolve any complaints or concerns from construction noise by coordinating activities and informing the community of the timing of the expected construction noise at the closest NSRs to avoid conflicts. For example, if blasting for foundation or removal of ledge or other potentially noisy activities were required during the construction period, nearby residents would be notified in advance.

Construction traffic would use both Papaka Road and Kula Highway for deliveries. Auwahi Wind would coordinate with individual landowners regarding the operation of trucks, cars, and other vehicles on private site access roadways to prevent the unexpected noise from construction- and transport-related vehicles. For the public roadways along Wailea, Makena, and Kula, the construction truck traffic would be similar to existing truck traffic currently occurring along these roadways.

Wind Farm Site Operations – Noise associated with operation of the Auwahi Wind project was analyzed using DataKustik GmbH's CadnaA, the computer-aided noise abatement program (v 4.0.136). CadnaA is a comprehensive three-dimensional acoustic software model that conforms to the International Organization for Standardization (ISO) standard ISO 9613-2, *Attenuation of Sound during Propagation Outdoors*. The engineering methods specified in this standard consist of full (1/1) octave band algorithms that incorporate geometric spreading from wave divergence, reflection from surfaces, atmospheric absorption, screening by topography and obstacles, ground effects, source directivity, heights of sources and receptors, seasonal foliage effects, and meteorological conditions. Manufacturer sound power level data for the Siemens 3.0-MW WTGs were input into the model, inclusive of the manufacturer-stated warranty confidence interval.

Operational broadband (dBA) sound pressure levels were calculated assuming that all WTGs are operating continuously and concurrently at the maximum manufacturer-rated sound level for WTG cut-in and full rotational operating conditions. The cut-in wind speed at hub height is the lowest wind speed at which a WTG begins producing usable power. Though WTGs generate less noise under these conditions, there is the potential for increased audibility given the lower ambient levels and reduced masking as compared to sound levels generated under the maximum rotational operation condition and wind speeds. WTGs at maximum rotational operation is the assumed worst case condition in terms of noise generation by the WTGs and was used for comparisons with the applicable regulatory criteria. Potential noise impacts at cut-in and maximum rotational conditions are summarized in Table 4.13-1. Sound contour isopleths for the maximum rotational operating condition are shown in Figure 4-1. The tabulated results and contour plots are independent of the existing acoustic environment (i.e., are representative of expected project-generated sound levels only).

Special consideration is required for culturally significant and conservation land areas, specifically, users of the Hoapili Trail (King's Highway) located south of the wind farm site. As shown in Figure 3-9 the 45 dBA contour limit that applies to conservation and preservation lands (10:00 p.m. to 7:00 a.m.) extends past the southern property line indicating that received sound levels may periodically exceed nighttime limits. Although this area is uninhabited, persons traveling on the

Hoapili Trail or using the coastal areas for fishing, camping, and cultural practices may hear a gentle swooshing sound characteristic of wind farms, with audibility limited to trail areas closest to the site.

The received sound would be well within EPA guidelines of 70 dBA for publicly accessible areas and comparatively low level sound would not be expected to interfere substantially with the use and enjoyment of the trail and surrounding areas. It is unlikely that any further abatement options are available to further reduce levels to meet Hawaii Community Noise Regulation standards in these conservation areas; therefore, the Auwahi Wind project may seek a variance from the HDOH as provided for in HAR § 11-46-8.

Table 4.13-1. Summary of WTG acoustic model output (dBA).

Receptor ID	Receptor Status	HDOH Day/Night Limit	Siemens SWT-3.0-101 Range of Sound Levels	
			Cut-in[1/]	Maximum
1	Not Probable NSR	70/70	3	12
2	Not Probable NSR	70/70	3	14
3	Not Probable NSR	70/70	3	14
4	Not Probable NSR	70/70	5	16
5	Not Probable NSR	70/70	4	16
6	Probable NSR	50/45	5	16
7	Not Probable NSR	70/70	5	17
8	Not Probable NSR	70/70	5	17
9	Not Probable NSR	70/70	6	17
10	Not Probable NSR	70/70	5	17
11	Not Probable NSR	70/70	5	17
12	Not Probable NSR	70/70	6	17
13	Not Probable NSR	70/70	6	17
14	Not Probable NSR	70/70	6	18
15	Not Probable NSR	70/70	6	18
16	Not Probable NSR	70/70	6	18
17	Not Probable NSR	70/70	7	18
18	Not Probable NSR	70/70	7	18
19	Probable NSR	50/45	6	17
20	Probable NSR	50/45	6	18
21	Probable NSR	50/45	6	18
22	Not Probable NSR	70/70	10	22
23	Not Probable NSR	70/70	8	20
24	Not Probable NSR	70/70	6	17
25	Not Probable NSR	70/70	11	23
26	Not Probable NSR	70/70	24	34
27	Not Probable NSR	70/70	26	35
28	Not Probable NSR	70/70	8	19
29	Not Probable NSR	70/70	9	20
30	Not Probable NSR	70/70	8	19

Table 4.13-1. Summary of WTG acoustic model output (dBA).

Receptor ID	Receptor Status	HDOH Day/Night Limit	Siemens SWT-3.0-101 Range of Sound Levels	
			Cut-in[1/]	Maximum
31	Not Probable NSR	70/70	7	19
32	Not Probable NSR	70/70	7	18
33	Probable NSR	50/45	7	18
34	Probable NSR	50/45	7	18
35	Not Probable NSR	70/70	6	17
36	Not Probable NSR	70/70	6	17
37	Not Probable NSR	70/70	6	18
38	Not Probable NSR	70/70	7	18
39	Not Probable NSR	70/70	7	18
40	Not Probable NSR	70/70	7	18
41	Not Probable NSR	70/70	6	18
42	Not Probable NSR	70/70	6	18
43	Not Probable NSR	70/70	5	17
44	Not Probable NSR	70/70	5	16
45	Not Probable NSR	70/70	5	17
46	Not Probable NSR	70/70	6	17
47	Not Probable NSR	70/70	5	17
48	Probable NSR	50/45	5	17
49	Not Probable NSR	70/70	6	17
50	Not Probable NSR	70/70	7	19
51	Probable NSR	50/45	8	19
52	Not Probable NSR	70/70	8	20
53	Not Probable NSR	70/70	8	19
54	Not Probable NSR	70/70	10	21
55	Probable NSR	50/45	27	38
56	Probable NSR	50/45	29	41
57	Not Probable NSR	70/70	32	44
58	Probable NSR	50/45	19	31
59	Not Probable NSR	70/70	13	25

1/ The cut-in wind speed at hub height is the lowest wind speed at which a WTG begins producing usable power.
dBA = A-weighted decibels; HDOH = Hawaii State Department of Health; NSR = noise sensitive receptor

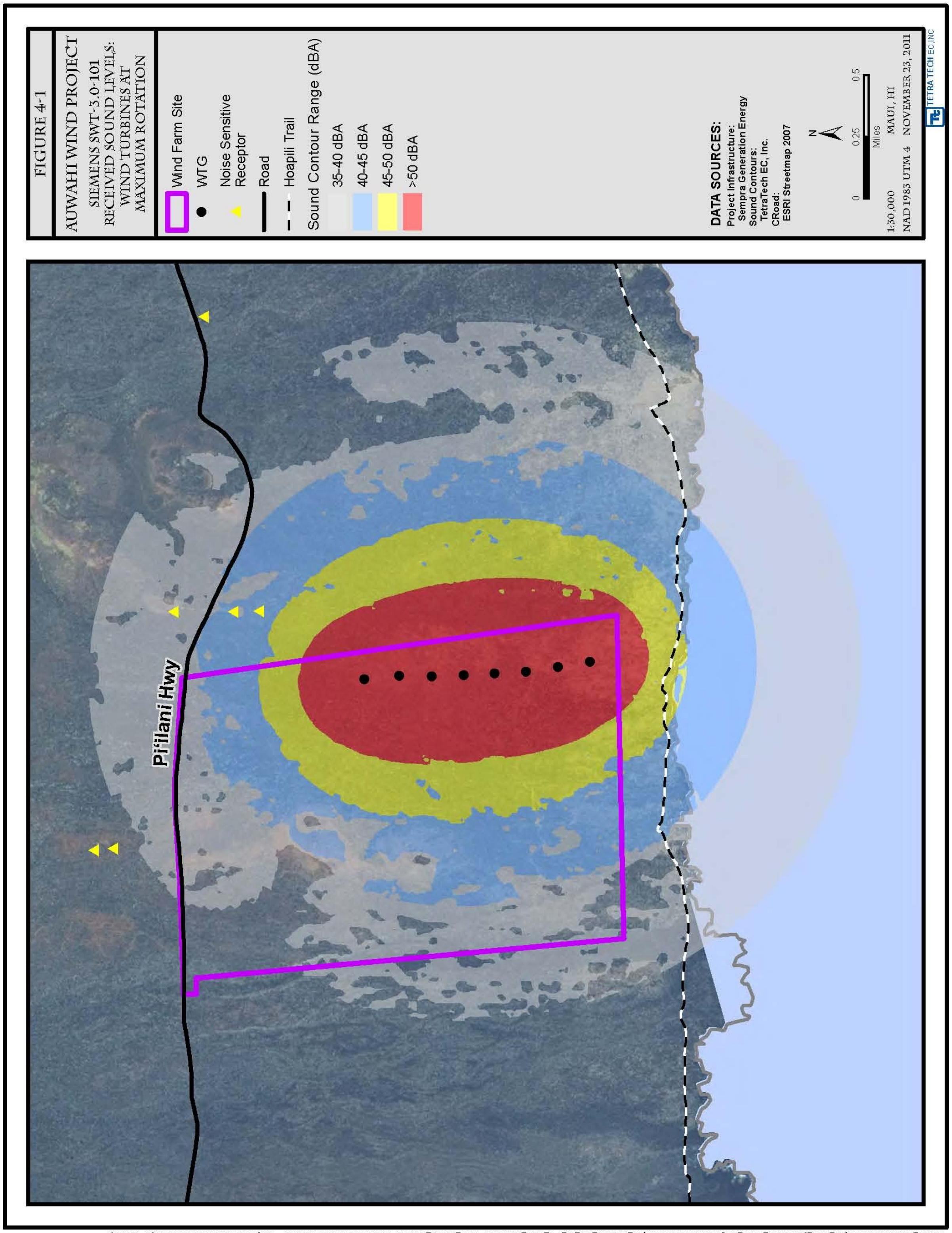
FIGURE 4-1
AUWAHI WIND PROJECT
SIEMENS SWT-3.0-101
RECEIVED SOUND LEVELS:
WIND TURBINES AT
MAXIMUM ROTATION
Wind Farm Site
WTG
Noise Sensitive Receptor
Road
Hoapili Trail
Sound Contour Range (dBA)
35-40 dBA
40-45 dBA
45-50 dBA
>50 dBA
DATA SOURCES:
Project Infrastructure:
Sempra Generation Energy
Sound Contours:
TetraTech EC, Inc.
CRoad:
ESRI Streetmap 2007
N
0 0.25 0.5
Miles
1:30,000
NAD 1983 UTM 4
MAUI, HI
NOVEMBER 23, 2011
TETRA TECH EC, INC
Pi'ilani Hwy

Generator-tie Line – Generator-tie lines, like transmission lines, have the potential to emit environmental noise (also called corona noise) under certain operating and environmental conditions. Modern generator-tie lines are designed, constructed, and maintained so that during dry conditions they operate below the corona inception voltage; that is, the line would generate a minimum of corona-related noise. During dry weather conditions, noise from the proposed lines would be generally indistinguishable from background sound levels at locations beyond the edge of the corridor, with slightly higher sound during rain events, but overall sound levels at the edge of the corridor are expected to remain relatively low.

Implementation of the noise mitigation measures listed in Chapter 2, including adhering to timing restrictions for noisy construction traffic, maintaining equipment and vehicles, and establishing a process for responding to noise complaints, will minimize the effects of construction and operational noise in areas affected by the Auwahi Wind project. Together these measures will result in less than significant impacts related to noise.

4.13.2.3 Cumulative Impacts

Implementation of the HCP would produce short-term construction noise; however, no adverse impacts to sensitive receptors would occur because all noise levels would comply with Maui County Noise standards. Construction of the Auwahi Wind project would also result in increased noise levels due to use of large equipment and periodic noise-producing construction activities (i.e., blasting), traffic generated during construction, and sounds produced by operating wind turbines. The project has been designed to operate in accordance with Hawaii Community Noise Regulations (HAR § 11-46) at all noise sensitive receptors, though during operation may periodically exceed nighttime noise thresholds for uninhabited conservation lands located south of the wind farm. Received sound in these areas would be well within EPA guidelines for publically accessible areas.

A new wind farm would need to be within approximately 1.2 to 1.8 miles (2 to 3 km) of the proposed wind farm site to present a possible cumulative influence on sound. There is no known existing or proposed wind farm within this distance from the Auwahi Wind project; therefore, cumulative sound levels would not result from the Auwahi Wind project operating in conjunction with any other wind farms. Foreseeable projects along the construction access route (the two road improvement projects and ongoing use of ranch roads), in the mitigation areas (ongoing and foreseeable restoration work), and near the interconnection substation (Honuaula) also have the potential to result in short-term increased noise levels, which may overlap the CIAA for noise. It is assumed that all work would comply with applicable noise regulation; therefore, the direct and indirect effects of the Proposed Action in combination with other projects would have no adverse cumulative impact associated with noise.

4.13.2.4 Conclusion

Implementation of the HCP would result in minor, short-term noise impacts associated with construction equipment and vehicles. Moderate, short-term increases in noise would occur in association with construction of the Auwahi Wind project; however, all applicable HDOH permit requirements would be followed and Auwahi Wind would work to resolve noise complaints and concerns to mitigate these impacts. Minor, long-term noise would also occur during wind project operation; however all noise would comply with EPA guidelines. Therefore, direct, indirect, and cumulative effects of implementing the Proposed Action on noise, when minimized and mitigated as proposed, would be minor.

4.13.3 Alternative 3 – Reduced Permit Term

4.13.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with implementing the proposed HCP under Alternative 3 with respect to noise would be slightly less than as described under the Proposed Action. This would be because the work period for installation or retrofitting of a mitigation fence at the Waihou Mitigation Area and Kahikinui Forest Project, if fencing were to become a viable option in the future, could be shorter than under the Proposed Action due to reduced take levels, and associated mitigation requirements.

4.13.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 related to noise would be the same as under the Proposed Action, but for a shorter duration due to the reduced operating period.

4.13.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.13.3.4 Conclusion

Impacts of Alternative 3 related to noise from implementation of the HCP would be less than under the Proposed Action, due to shorter work periods for installation of mitigation fences. Moderate, short-term increases in noise would occur during construction and minor, long-term increases in noise would occur during operation of the wind farm, as under the Proposed Action, though for a shorter duration due to the reduced operating period. Therefore, direct, indirect, and cumulative effects of implementing Alternative 3 on noise, when minimized and mitigated as proposed, would be minor.

4.14 CULTURAL RESOURCES

4.14.1 Alternative 1 – No Action

4.14.1.1 Potential Impacts of Alternative 1

The implementation of the No Action Alternative would have no effect on the historic properties and other archaeological and cultural resources because the ITP would not be issued, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Current use of the analysis area does not pose a risk of destruction of archaeological and cultural resources present there.

4.14.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP, the HCP would not be implemented, and the Auwahi Wind project would not be constructed. Therefore, Alternative 1 would not contribute to cumulative impacts to cultural resources.

4.14.1.3 Conclusion

Alternative 1 would have no effect on cultural resources because no action would be undertaken.

4.14.2 Alternative 2 – Proposed Action

4.14.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Implementation of mitigation at the Waihou Mitigation Area is not expected to impact archaeological or cultural resources as ground disturbing activities would occur along the existing fenceline which has been previously disturbed. Customary and traditional uses related to subsistence, cultural or religious purposes at the Kahikinui mitigation site and in the vicinity at the summit area of Haleakala would not be affected by predator control activities. Auwahi Wind acknowledges the importance of the connection between Native Hawaiian people and the land (aina). Therefore, should predator-proof fencing become a viable option at Kahikinui at some point in the future, or should a conflict develop related to Native Hawaiian rights, Auwahi Wind would consult with the SHPD to determine pre-construction survey requirements and other measures to avoid and minimize impacts to historical, cultural, and archaeological resources.

Prior to commencing any ground disturbing activities at the Kahikinui Forest Project for installation of a petrel fence, should fencing become a viable option in the future, any areas to be disturbed will be surveyed by a qualified specialist to ensure that all historical, cultural, and archaeological resources are avoided and impacts to any cultural practices are minimized. Therefore, installation of a fence is not anticipated to adversely impact archaeological resources. Contractor documents would include precautionary measures for the inadvertent discovery of cultural remains such as stopping work in the immediate area of the discovery and immediately notifying the SHPD. None of the other mitigation activities proposed would impact archaeological or cultural resources because they do not involve substantial ground disturbance.

4.14.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Within the current APE, the project has been designed to avoid, by preservation-in-place, all sites recommended as eligible under NRHP Criterion (c) because of the high degree of workmanship (which are no longer in the APE) and the sites recommended as potentially eligible to the HRHP criterion (e) because they contain human burials or are suspected to contain human burials. As described in Chapter 2, these features include four known burial sites and several potential burial mound complexes which will be treated in accordance with the final Burial Treatment Plan, anticipated to be approved by SHPD and the Maui Lanai Island Burial Council in November 23, 2011. Key components of the Burial Treatment Plan are listed in Section 2.2.4.

The construction of the Auwahi Wind project could potentially have direct adverse impacts to the remaining 143 sites (consisting primarily of rock walls, agricultural mounds, terraces) recommended as potentially eligible to the NRHP criterion (d) for their information potential. If not mitigated this would be considered an adverse effect to historic properties by SHPD. Considerable effort has been exercised to minimize the impact the project would have on the archaeological resources present in the wind farm site. Moreover, based on the density of features recorded in the APE, the Auwahi Wind project would maintain over 85 percent (this assumes that all features within the APE are impacted) of all the features within the entire south Auwahi parcel (Shapiro et al. 2011b), a substantially greater proportion that most other development projects where avoidance of such sites is typically not possible. As noted in Section 2.2.4, Auwahi Wind's design engineers continue to consider construction methods and design modifications that can be adopted to avoid and minimize direct impacts, including the use of spanning devices to avoid lava tubes that may contain archaeological and cultural sites. Thus, the 143 sites addressed here represent a worst case scenario because Auwah Wind assumes that some of them will ultimately be avoided.

In the event that avoidance of the criterion (d) sites is not possible, treatments have been proposed for, in the form of archaeological data recovery investigations to mitigate the adverse effects caused by development of the project. Some of the archaeological resources present within the APE were fully documented during the AIS efforts and will not require any further archaeological work; others will require additional detailed mapping and excavations. That is, the excavations are designed to retrieve the significant information. Once retrieved, the destruction has been mitigated and there is no longer an adverse effect. Proposed treatments, including preservation-in-place, for each of the features in the current APE are listed in Cultural Resource Mitigation Plan included in Appendix C. Section 2.2.4 summarizes the treatments that will be used to fully mitigate the impacts to resources that require additional investigation. Pacific Legacy has prepared a Data Recovery Plan, approved by SHPD, for those sites where Data Recovery investigations will take place. Though final approval of the Burial Treatment Plan is pending, SHPD has concurred with the proposed treatment plans for sites slated for preservation, data recovery (including the type/degree of data recovery) and those sites for which no further work is warranted.

Internal wind farm site access roads could have an indirect adverse effect on archaeological and cultural resources during operation of the Auwahi Wind project by providing access to resources that were previously difficult to reach. This could allow increasing vandalism and theft of eligible resources that have been avoided by construction. To prevent this, Auwahi Wind will implement additional measures to minimize the potential for theft and vandalism at recorded historic sites including fencing of sites, development and implementation of a Worker Environmental Awareness Program, and possibly the monitoring and patrolling of significant sites (see Section 2.2.4). Collectively, these measures will result in less than significant impacts to cultural resources.

It is important to note that the Ulupalakua Ranch has been a privately held property with restricted access for over 100 years (Shapiro et al. 2011b). As described in the SAIS, the heiau and other sites with ritual functions documented within the wind farm site during archaeological surveys are thought to be associated with the agricultural pursuits that dominated the area. Thus, there are no traditional or cultural uses of the APE that would be interrupted by the Auwahi Wind project.

4.14.2.3 Cumulative Impacts

Impacts to archaeological and cultural resources associated with fence construction is anticipated to be minimal because fencing around the Waihou Mitigation Area would occur along the existing fenceline which has been previously disturbed and pre-construction surveys would be conducted at Kahikinui, should installation of a predator-proof fence become a viable option at some point in the future. No impacts to customary or traditional uses by Native Hawaiians would occur as a result of implementing mitigation. Likewise, the Auwahi Wind project would not result in adverse impacts to archaeological and cultural resources because standard avoidance and minimization measures have been incorporated into the project design, and mitigation for impacted properties has been determined to be adequate by SHPD. None of the projects in Table 4.1-2 overlap with the CIAA for Archaeological and Cultural Resources; therefore, there would be no cumulative effects.

4.14.2.4 Conclusion

Alternative 2 would avoid all culturally significant resources, including those meeting criteria “c” and “e” under the NHPA; however, construction of the Auwahi Wind project has the potential for moderate adverse impact to some cultural resources meeting criterion “d” (information potential). These impacts would be mitigated through treatments, approved by SHPD, directed toward cultural resources data collection from these sites. Therefore, direct, indirect, and cumulative effects of implementing the Proposed Action on cultural resources, when avoided, minimized, and mitigated as proposed, would be minor.

4.14.3 Alternative 3 – Reduced Permit Term

4.14.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Potential impacts associated with implementation of the proposed HCP under Alternative 3 would be the same as under the Proposed Action.

4.14.3.2 Potential Impacts of the Construction and Operation of the Auwahi Wind Project

Potential impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 related to archaeological resources would be the same as under the Proposed Action.

4.14.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.14.3.4 Conclusion

Alternative 3 would have the same impacts to cultural resources as the Proposed Action. Alternative 3 would avoid all culturally significant sites, but like the Proposed Action, has the potential to have a moderate adverse impact to sites identified as having information potential in association with construction and operation of the Auwahi Wind project. These impacts would be mitigated through treatments, approved by SHPD, directed toward cultural resources data collection from these sites. Therefore, direct, indirect, and cumulative effects of implementing Alternative 3 on cultural resources, when avoided, minimized, and mitigated as proposed, would be minor.

4.15 SOCIOECONOMIC RESOURCES

4.15.1 Alternative 1 – No Action Alternative

4.15.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, the ITP would not be issued and therefore the HCP would not be implemented and the Auwahi Wind project would not be constructed. Existing conditions would not change; however, the socioeconomic impact would vary. It would be favorable to those who value protection of natural open space lands, but unfavorable to those who value the development of wind energy resources to support renewable energy goals. Potential economic gains from the development of the Auwahi Wind project would not occur under this alternative. The existing demand on fossil fuels would continue and oil prices can vary dramatically depending on world conditions. Under the No Action Alternative, new jobs and revenue would not be created; therefore, there would be minor adverse effects on the local economy.

4.15.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP and therefore the HCP would not be implemented and the Auwahi Wind project would not be constructed. All of the activities indicated in Table 4.1-2 would likely continue. While the current economic situation may slow or postpone these developments, there is no evidence or change in local regulation that would indicate that they will not eventually be constructed. Because the primary impact of Alternative 1 would be the lack of beneficial impacts to the local economy, Alternative 1 would make a negligible contribution to cumulative impacts to socioeconomic resources.

4.15.1.3 Conclusion

Alternative 1 would have minor adverse impact to socioeconomic resources because no action would be undertaken, resulting in the lack of beneficial impacts to the local economy.

4.15.2 Alternative 2 – Proposed Action

4.15.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Implementation of the issuance of the ITP and implementation of the proposed HCP is not expected to impact socioeconomic resources near the Auwahi Wind project. An economic benefit of the HCP would be increased funding available to employ seasonal work associated with restoration activities at the Auwahi Forest Restoration Project, Waihou Mitigation Area, and Kahikinui Forest Project.

4.15.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Population, Diversity, and Economy – The Auwahi Wind project does not conflict with any general or community plan goals intended to account for population growth because the Auwahi parcel is not designated for future housing. Housing and infrastructure needed to accommodate the projected population growth near the project would still be achieved according to the policies of the Maui Island Plan and local community plans.

The Auwahi Wind project is expected to result in small, beneficial impacts related to local economy, employment, and electricity rates. At its peak activity during the 10-month construction period, the project would generate approximately 150 short-term construction jobs; during the operations phase, approximately 5 full-time jobs for skilled operators would be employed by Auwahi Wind. The estimated cost for construction would be $140 million, of which approximately $62.25 million (45 percent) would be spent in Hawaii. In addition, short-term indirect impacts would result from purchases of goods and services during construction of the Auwahi Wind project. During operation, the set rate established by the PPA for the energy generated by the Auwahi Wind project would provide a stable price for electricity and avoid the fluctuations resulting from the cost of crude oil.

Environmental Justice – The Auwahi Wind project is not expected to result in significant environmental, human health, or economic impacts on surrounding populations. No persons or populations would be displaced as a result of the project. While there are low-income and minority persons living in Maui County, none of the activities associated with construction and operation of the Auwahi Wind project would result in any adverse or disproportionate environmental impacts to minority or low-income persons or populations in the County. Furthermore, the Auwahi Wind project would benefit the local economy. Therefore, the proposed Auwahi Wind project complies with Executive Order 12898.

4.15.2.3 Cumulative Impacts

The implementation of the HCP would result in a minor amount of temporary, seasonal construction employment. Construction and operation of the Auwahi Wind project would result in small, beneficial impacts related to the local economy, employment, and electricity rates. No persons or populations would be displaced as a result of the either the implementation of the HCP or construction and operation of the Auwahi Wind project. Similar impacts would also occur in association with the existing and proposed Maui wind projects. The Honuaula project would also result in short-term construction jobs. Therefore, the direct and indirect effects of the Proposed

Action in combination with other projects would have a minor beneficial cumulative impact to the local economy.

4.15.2.4 Conclusion

Alternative 2 would benefit local employment through temporary job creation associated with implementation of the HCP. Short-term and long-term job creation as well as potential long-term stabilization of electricity rates associated with the Auwahi Wind project would benefit the local economy, employment and electricity rates. Therefore, direct, indirect, and cumulative effects of implementing the Proposed Action on socioeconomic resources would be minor and beneficial in the long-term.

4.15.3 Alternative 3 – Reduced Permit Term

4.15.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with implementation of the HCP under Alternative 3 related to socioeconomic resources would be the same as under the Proposed Action.

4.15.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 related to socioeconomic resources would be the same as under the Proposed Action. However, long-term potential benefits due to stabilization of electricity rates would be reduced due to the shorter operating period.

4.15.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.15.3.4 Conclusion

Alternative 3 would benefit local employment through temporary job creation associated with implementation of the HCP. Short-term and long-term job creation as well as potential long-term stabilization of electricity rates associated with the Auwahi Wind project would benefit the local economy, employment and electricity rates. Long-term benefits of electricity rate stabilization would be lower than the Proposed Action due to the shorter operating period. Therefore, direct, indirect, and cumulative effects of implementing Alternative 3 on socioeconomic resources would be minor.

4.16 HAZARDOUS AND REGULATED MATERIALS AND WASTES

4.16.1 Alternative 1 – No Action Alternative

4.16.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, the ITP would not be issued and therefore the HCP would not be implemented and the Auwahi Wind project would not be constructed. There would be no new construction at the site and the area would continue to be undeveloped and used for cattle grazing. No additional hazardous materials would be transported, stored, used, or disposed of at the site; therefore, there would be no impacts.

4.16.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP and therefore the HCP would not be implemented and the Auwahi Wind project would not be constructed. Therefore, Alternative 1 would make not contribution to cumulative impacts associated with hazardous and regulated materials and wastes.

4.16.1.3 Conclusion

Alternative 1 would have no effect on hazardous and regulated materials and wastes because no action would be undertaken.

4.16.2 Alternative 2 – Proposed Action

4.16.2.1 Potential Impacts of the Proposed HCP Conservation Measures

There are no known hazardous substances present at the mitigation sites, which consist of undeveloped land. The conservation measures associated with the HCP involve the use of construction equipment, which requires the use of minor amounts of hazardous or regulated materials such as oil, solvents, and fuel. The fencing contractor will be required to implement standard BMPs for the preventing the release of hazardous substances.

4.16.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Construction of the Auwahi Wind project involves the routine transport, use, storage, and disposal of hazardous materials, including antifreeze, diesel fuel, gasoline, hydraulic oil, lube oil, grease, and mineral oil. Other hazardous or regulated materials that would be used during construction include paints, adhesives, curing compounds, concrete, bentonite, and fertilizer. Construction equipment used to mix and pour concrete would be washed onsite because it would not be practical to remove this equipment from the site for washing. In the event of accidental releases or spills from the routine transport, use, storage, and disposal of hazardous materials, Auwahi Wind would implement its SPCC plan, as described in section 2.2.4.

Auwahi Wind would obtain any permits or authorizations related to hazardous materials prior to starting construction and would prepare and implement a Hazardous Materials and Waste Management (HMWM) plan that details proper procedures for storing and using hazardous materials and storing and disposing of hazardous waste. The plan would be project-specific, would pertain to both construction and operations, and would contain sufficient detail to address the purpose of the plan and to readily translate into the actions necessary to comply with relevant regulations. The plan would include information about site activities, site contacts, worker training procedures, and a hazardous materials inventory in accordance with Article 80 of the Uniform Fire Code. A qualified hazardous materials management professional, such as a Certified Hazardous Materials Manager, would prepare and oversee implementation of the plan. The HMWM plan would include emergency response procedures for site personnel and would also be provided to local emergency responders.

Construction activities would generate waste including construction debris, concrete wash water, used oil, and other vehicle fluids, and restroom waste. Operations activities would generate waste oil from the WTGs. Auwahi Wind would dispose of all waste, including non-hazardous waste, offsite at appropriately permitted facilities. Facilities where waste may be disposed of and the type of waste each facility accepts are discussed in Section 4.18 – Public Infrastructure and Services. The HMWM plan, updated to address O&M activities, would detail proper waste storage and disposal procedures. The impacts associated with disturbance of existing contamination or improper handling of waste generated during construction and operations would be less than significant with implementation of the HMWM plan.

4.16.2.3 Cumulative Impacts

Implementation of the HCP and construction and operation of the Auwahi Wind project would have no measureable impact to hazardous and regulated materials or wastes because all construction plans will require standard spill prevention and hazardous materials BMPs. Other ongoing or foreseeable actions that have the potential to result in spills within the CIAA for hazardous and regulated materials and wastes include use of the harbor for the KWP II project; use of construction equipment associated with restoration work at the Auwahi Forest Restoration Project and Kahikinui Forest Project; and existing ranch activities. It is assumed that all activities would implement standard spill prevention and hazardous materials handling measures; therefore, the direct and indirect effects of the Proposed Action in combination with other projects would have no measureable cumulative impact associated with hazardous and regulated materials and wastes.

4.16.2.4 Conclusion

Direct, indirect, and cumulative effects of implementing the Proposed Action on hazardous and regulated materials and wastes, with the implementation of standard BMPs as proposed, would be negligible.

4.16.3 Alternative 3 – Reduced Permit Term

4.16.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with implementation of the proposed HCP under Alternative 3 related to hazardous and regulated materials and wastes would be the same as under the Proposed Action.

4.16.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project related to hazardous and regulated materials and wastes under Alternative 3 would be the same as under the Proposed Action.

4.16.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.16.3.4 Conclusion

Direct, indirect, and cumulative effects of implementing Alternative 3 on hazardous and regulated materials and wastes, with the implementation of standard BMPs as proposed, would be negligible.

4.17 PUBLIC AND CONSTRUCTION SAFETY

4.17.1 Alternative 1 – No Action Alternative

4.17.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, the ITP would not be issued and therefore the HCP would not be implemented and the Auwahi Wind project would not be constructed. Conditions affecting public safety would remain as they are under existing conditions. Open pastureland used for Ulupalakua Ranch's active ranching operation would remain unchanged. No effects on public safety are expected under the No Action Alternative.

4.17.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP and therefore the HCP would not be implemented and the Auwahi Wind project would not be constructed. Therefore, Alternative 1 would not contribute to cumulative impacts on public and construction safety.

4.17.1.3 Conclusion

Alternative 1 would have no effect on public and construction safety because no action would be undertaken.

4.17.2 Alternative 2 – Proposed Action

4.17.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Potential safety issues associated with implementation of the HCP relate to the exposure of project biologists or other technicians onsite conducting post-construction fatality monitoring to hazards such as tower collapse, blade throw, stray voltage, and lightening (described in detail below). All personnel involved in post-construction fatality monitoring or other elements of the HCP mitigation strategy would receive safety training prior to commencing work on site and would be required to follow the Site Safety Handbook (see below for additional details). None of the other mitigation activities pose a risk to public or construction worker safety. Therefore, less than significant impacts to public safety would be expected.

4.17.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Potential safety issues during construction are associated with public access to the Auwahi Wind project during construction and accidents or injuries of construction workers. Workers and the general public could be injured from the movement of construction vehicles, equipment, and materials. A Site Safety Handbook would be prepared and implemented prior to the start of construction. All persons entering the construction areas would be required to review and adhere to the Site Safety Handbook. This handbook would include measures such as establishing safety zones or setbacks from construction work areas and would identify requirements for temporary fencing around staging areas, storage yards, and excavations during construction to control and restrict public access to the construction area, as well as outline worker safety practices.

Tower Collapse/Blade Throw – Safety hazards related to WTGs include collapse of the WTG tower and rotor blades breaking causing parts to fall or be thrown from the nacelle. It is very rare for a WTG to collapse or a rotor blade to be dropped or thrown from the nacelle, but such incidents do occur and are potentially dangerous for site personnel and the general public. Implementing the measures outlined in the Site Safety Handbook and designing and constructing the WTGs per industry specifications and standards would minimize the potential for tower collapse and blade throw. The WTGs are set back from the parcel line at least 134 m (440 ft), and the public would not have access to the site. For these reasons, less than significant impacts to public safety would be expected.

Stray Voltage – When electrical systems are grounded some current flows through the earth and a small voltage develops at each point where the system is grounded. Stray voltage can occur if unbalanced neutral currents flow in the earth through ground rods, pipes, or other conducting objects in a facility (AWEA 2008). Stray voltage may come from damaged or poorly connected wiring systems, corrosion on either end of the wires, or weak or damaged insulation materials on the "hot" wire. Construction of the generator-tie line would follow standard industry procedures including structure assembly and erection, ground wire, and conductor stringing. O&M activities would include routine monitoring, inspection, and maintenance by qualified personnel. No impacts to public safety from stray voltage are expected.

Electric and Magnetic Fields – Power lines, like the energized components of electrical motors, home wiring, lighting, and all electrical appliances, produce electric and magnetic fields, commonly referred to as EMF. The EMF produced by the alternating current electrical power system in the United States has a frequency of 60 Hz, meaning that the intensity and orientation of the field changes 60 times per second. Power line fields of 60 Hz are considered to be extremely low frequency.

Electric fields around generator-tie lines and transmission power lines are produced by electrical charges on the energized conductor. Electric field strength increases with the line voltage and decreases as one moves farther away from the line. The strength of the electric field is measured in kilovolts per meter. Magnetic fields around generator-tie lines and transmission power lines are produced by the amount of current flow, measured in terms of amperes, through the conductors. The magnetic field strength also increases as current flow increases and diminishes with increasing distance from the conductors. Magnetic fields are measured in milligauss.

The potential EMF produced by the generation and export of electricity from the WTGs would have no effect on the health and safety of the public or the workers at the wind farm site. The electrical collection system would be constructed underground and the design of the generator-tie line would adhere to industry standards minimizing EMF exposure.

4.17.2.3 Cumulative Impacts

Implementation of the HCP would not result in adverse impacts to public or construction safety. Likewise, the Auwahi Wind project has been designed to incorporate measures that minimize the risk of wildfire, address the potential for WTG and generator-tie line failure, and address access-related safety issues. Similar measure would be anticipated for other foreseeable projects. Therefore, the direct and indirect effects of the Proposed Action in combination with these projects would not result in an adverse cumulative impact to public and construction safety.

4.17.2.4 Conclusion

Direct, indirect, and cumulative effects of implementing the Proposed Action on public and construction safety, with adherence to industry design standards and implementation of the Site Safety Handbook as proposed, would be negligible.

4.17.3 Alternative 3 – Reduced Permit Term

4.17.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with implementation of the proposed HCP under Alternative 3 related to public and construction safety would be the same as under the Proposed Action.

4.17.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 related to public and construction safety would be the same as under the Proposed Action.

4.17.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.17.3.4 Conclusion

Direct, indirect, and cumulative effects of implementing Alternative 3 on public and construction safety, with adherence to industry design standards and implementation of the Site Safety Handbook as proposed, would be negligible.

4.18 PUBLIC INFRASTRUCTURE AND SERVICES

4.18.1 Alternative 1 – No Action Alternative

4.18.1.1 Potential Impacts of Alternative 1

Under the No Action Alternative, conditions affecting public infrastructure and services would remain as they are currently. The ITP would not be issued and therefore the HCP would not be implemented and the Auwahi Wind project would not be built. No effects on public infrastructure and services are expected under the No Action Alternative.

4.18.1.2 Cumulative Impacts

Under the No Action Alternative, the USFWS would not issue an ITP and therefore the HCP would not be implemented and the Auwahi Wind project would not be constructed. Therefore, Alternative 1 would not contribute to cumulative impacts to public infrastructure and services.

4.18.1.3 Conclusion

Alternative 1 would have no effect on public infrastructure and services because no action would be undertaken.

4.18.2 Alternative 2 – Proposed Action

4.18.2.1 Potential Impacts of the Proposed HCP Conservation Measures

Implementation of the proposed HCP is not expected to impact public infrastructure and services. Mitigation activities would be carried out primarily by people who reside locally. Specialists from other areas may be hired temporarily to conduct work but would be so few in number that they could easily be supported by the existing infrastructure and services.

4.18.2.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Electric – During construction, electricity would be required at the temporary modular office space. The electric demand to operate the modular office space would be minimal. If the permanent distribution line were installed prior to construction activities, the demand on the utilities would not be significant. The long-term operation of the O&M building and the met tower would increase electrical demand on MECO’s system; however, the increase would be minor resulting in less than significant impacts to the existing system. Over the long-term the project would provide a more reliable source of power for the MECO grid.

Solid Waste – Debris generated during construction of the Auwahi Wind project would temporarily increase solid waste streams from current levels. The capacities of the available waste disposal facilities would be sufficient to accommodate construction of the project. Therefore, waste from construction would not cause significant impacts to the existing facilities or exceed the capacity of the facilities. Solid waste generated from the long-term operation of the project would be minimal (see the Final EIS for the Auwahi Wind project (Tetra Tech 2011) for additional details).

Water and Wastewater – During construction, water would be required for dust suppression and emergency fire suppression. Approximately 60,000 gallons (227,124 liters) of water would be used per day on-site. As described in Section 3.5., seven options have been evaluated for providing water to the proposed wind farm site, including use of potable (4 options), brackish (1 option), and R1 recycled water (2 options) from either on-site or off-site sources. If a well is drilled onsite, there would be no impacts to the public water supply and distribution system. If water is derived from an off-site source, this would involve trucking water to the wind farm site, which would increase the amount of traffic along the construction access route.

Portable toilets would be provided during construction. Wastewater would be collected by a private contractor and transported to a regulated facility for disposal. During construction, the wastewater from portable toilets would be minimal and the existing treatment and disposal facilities have adequate capacity to accommodate the temporary increase in sanitary wastewater.

The O&M building would include a kitchen and bathrooms. Water may be provided by an onsite well or trucked in and stored in onsite storage tanks. If a well is drilled onsite, there would be no impacts to the public water supply and distribution system. Operation of the wind farm site would result in a minimal increase in demand; therefore, impacts to the public water supply and distribution system would not be expected to be significant.

An onsite septic system would be constructed for the O&M building for wastewater from the bathroom and kitchen facilities. Because of the small number of employees required to operate the proposed wind farm, a small amount of wastewater would be generated and impacts to the existing wastewater disposal and treatment facilities would not be expected to be significant.

Police and Fire Protection Services – An increased demand on police and fire services during construction of the Auwahi Wind project is expected. Fire, police, and emergency services are all available, and impacts on these services would be less than significant because the agencies have sufficient capacity to respond to incidents at the site and emergency response personnel would have the opportunity to review and comment on the project-specific FMP and emergency response plan so that responses would be properly coordinated with site personnel.

Health Care Facilities and Emergency Medical Services – During construction, the presence of equipment and materials and the increased presence of site personnel would increase the potential for injury and need for medical care and emergency services. All persons entering the construction areas would be required to review and adhere to the Site Safety Handbook. Existing services are expected to be adequate to accommodate illness or injuries from construction-related incidents.

Education Facilities – There would be no impacts to education facilities from the construction or operations of the Auwahi Wind project.

Recreation Facilities – The Haleakala National Park and the Kula Forest Reserve are several miles from the Auwahi Wind project. Construction and operations of the Auwahi Wind project would not affect users of these recreational areas. The Auwahi Wind project is adjacent to the Kanaio NAR and north of the Hoapili Trail. The use of these facilities would not be interrupted by construction or operations of the project.

4.18.2.3 Cumulative Impacts

Implementation of the HCP would not result in impacts to public infrastructure and services. Construction and operation of the Auwahi Wind project would result in a minor increase in the use electricity, water, waste facilities, and wastewater treatment, and police and fire services; however, all existing facilities would be able to handle this increase. Therefore, no burden would be placed on public infrastructure and services as a result of the direct or indirect effects of the Proposed Action, and thus there is no potential for adverse cumulative impacts.

4.18.2.4 Conclusion

Under Alternative 2, implementation of the HCP would have negligible impacts to public infrastructure and services. Minor increases in the requirement for electricity, water, waste facilities, and wastewater treatment, and police and fire services would occur in association with construction and operation of the Auwahi Wind project; however, over the long-term operation of the project would have a beneficial impact by providing a reliable source of power. Therefore, direct, indirect, and cumulative effects of implementing the Proposed Action on public infrastructure and services would be minor.

4.18.3 Alternative 3 – Reduced Permit Term

4.18.3.1 Potential Impacts of the Proposed HCP Conservation Measures

Impacts associated with implementation of the proposed HCP under Alternative 3 related to public infrastructure and services would be the same as under the Proposed Action.

4.18.3.2 Potential Impacts of Construction and Operation of the Auwahi Wind Project

Impacts associated with construction and operation of the Auwahi Wind project under Alternative 3 related to public infrastructure and services would be the same as under the Proposed Action. However, the long-term benefit of providing a reliable source of power to the MECO grid would potentially be reduced due to the shorter operating period.

4.18.3.3 Cumulative Impacts

Cumulative impacts of Alternative 3 would be the same as under the Proposed Action.

4.18.3.4 Conclusion

Under Alternative 3, impacts to public infrastructure and services would be the same as under the Proposed Action. Implementation of the HCP would have negligible impacts to public infrastructure and services. Minor increases in the requirement for electricity, water, waste facilities, and wastewater treatment, and police and fire services would occur in association with construction and operation of the Auwahi Wind project; however, over the long-term operation of the project would have a beneficial impact by providing a reliable source of power. Therefore, direct, indirect, and cumulative effects of implementing Alternative 3 on public infrastructure and services would be minor.

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This EA was prepared by Tetra Tech. The following is a list of those involved in the preparation of the EA and their respective roles and experience. Reviews and input were provided by Mitch Dmohowski of Sempra Generation; and David Moser of Ebbin Moser + Skaggs LLP.

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APPENDIX A

AUWAHI WIND PROJECT REVEGETATION PLANT LIST AND LIST OF CANDIDATE TREE SPECIES FOR THE WAIHOU MITIGATION AREA

Auwahi Wind Project Revegetation Potential Plant List	
Common Name	***Scientific Name***
Trees	
wiliwili	*Erythrina sandwicensis*
iliahialoe	*Santalum ellipiticum*
ohe makai	*Reynoldsia sandwicensis*
alahee	*Canthium odoratum*
akoko	*Chamaesyce celastroides*
naio	*Myoporum sandwicense*
hao	*Rauvolfia sandwicensis*
aiea	*Nothocestrum latifolium*
koaia	*Acacia koai'a*
keahi	*Nesoluma polynesicum*
lama	*Diospyros sandwicensis*
Shrubs	
aalii	*Dodonaea viscosa*
kului	*Nototrichium sandwicense*
aweoweo	*Chenopodium oahuense*
maiapilo	*Capparis sandwichiana*
pua kala	*Argemone glauca*
uhaloa	*Waltheria indica*
kolomona	*Senna gaudichaudii*
unknown	*Achyranthes splendens*
mao	*Gossypium tomentosum*
akia	*Wikstroemia monticola*
Grasses	
pili	*Heteropogon contortus*
mountain pili	*Panicum tenufolium*
kawelu	*Eragrostis variabilis*
Guinea grass	*Panicum maximum*
Bufflegrass	*Pennisetum ciliare*
	Paspalum sp.
Ground Layer	
nehe	*Lipochaeta lavarum*
ilihee	*Plumbago zeylanica*
ilima	*Sida fallax*
alaala wai nui	*Peperomia leptostachya*
ulei	*Osteomeles anthyllidifolia*
Awikiwiki	*Canavalia pubescens*

List of Candidate Tree Species for the Waihou Mitigation Area

Common Name	*Scientific Name*
Ohia lehua	*Metrosideros polymorpha**
Koa	*Acacia koa**
Aalii	*Dodonaea viscosa**
Kolea lau nui	*Myrsine lessertiana**
Ulei	*Osteomeles anthyllidifolia***
Olapa	*Cheirodendron trigynum***
Naio	*Myoporum sandwicense***
Mamane	*Sophora chrysophylla***
Maua	*Xylosma hawaiiense***
Ohe mauka	*Polyscias oahuensis (formerly genus Tetraplasandra)****
Ohe ohe	*Polyscias kavaense (formerly genus Tetraplasandra)****
Kawau	*Ilex anomala****
Pilo	*Comprosma foliosa vontempsky****
Olomea	*Perrottetia sandwicensis****
Haiwale	*Cyrtandra sp.****
Opuhe	*Urera glabra****

*Will be most prevalently planted species

**Secondly most planted species

***Dependent upon availability and viability of seeds

APPENDIX B

BOTANICAL, AVIAN AND TERRESTRIAL MAMMALIAN SURVEYS CONDUCTED FOR THE AUWAHI WIND FARM PROJECT, ULUPALAKUA RANCH, ISLAND OF MAUI

APPENDIX C

AUWAHI WIND PROJECT CULTURAL RESOURCE MITIGATION PLAN

APPENDIX D
SUMMARY OF IMPACTS TO AND MITIGATION FOR SPECIAL STATUS SPECIES

Summary of Impacts to and Mitigation for Special Status Species

Resource	Impact	Mitigation/Conservation Measures
Loss of potential native plant habitat and potential habitat for the following endangered plants which occur in the Kanaio NAR adjacent to the generator-tie line: *Alectryon micrococcus* (Mahoe), *Bonamia menziesii*, *Cenchrus agrimoniodes* (Kamanomano), *Colubrina oppositifolia* (Kauila), *Flueggea neowawraea* (Mehamehame), *Melicope adscendens*(Alani), *Melicope knudsenii* (Alani), *Melicope mucronulata* (Alani)	Permanent loss of 30 acres of degraded native plant habitat.	Species will benefit from propagation and outplanting of 10 individuals of each species (aiea, iliahi, and red ilima); species will also benefit from mitigation for Blackburn's sphinx moths and Hawaiian hoary bats on Ulupalakua Ranch (see below). Impacts minimized through implementation of standard BMPs for invasive plants species, revegetating disturbed areas, and implementing the Fire Management Plan.
Direct impacts to listed plants.	Avoided: no listed plants within project footprint.	Listed plants in the vicinity of the project footprint will be fenced during construction to ensure direct impacts are avoided. Impacts minimized through implementation of standard BMPs for invasive plants species, revegetating disturbed areas, and implementing the Fire Management Plan.
Hawaiian yellow-faced bee mortality	Crushing of individual bees or ground nests; collision of bees with construction equipment. Loss of foraging habitat within developed areas of the project footprint.	Habitat restoration mitigation for Blackburn's sphinx moths and Hawaiian hoary bats on Ulupalakua Ranch (see below) will increase available native bee habitat.
Hawaiian yellow-faced bee Habitat Loss	Removal of vegetation used for nesting and/or individual plants used for pollen and nectar collection; habitat fragmentation (but no fragmentation of intact areas of native habitat); increased risk of the invasive species and wildfire.	Impacts minimized through implementation of standard BMPs for invasive plants species, revegetating disturbed areas, and implementing the Fire Management Plan. Species will also benefit from mitigation for Blackburn's sphinx moths and Hawaiian hoary bats on Ulupalakua Ranch (see below).
Hawaiian Petrel Take	Tier 1: 19 adults; 7 chicks Tier 2: 32 adults; 12 chicks Tier 3: 64 adults; 23 chicks	Petrel management measures including conducting predator control and monitoring at the Kahikinui Forest Project to the extent needed to offset take tier.
Hawaiian Hoary Bat Take	Tier 1: 5 adults; 2 young Tier 2: 10 adults; 4 young Tier 3: 19 adults; 8 young	Habitat restoration measures at Waihou Mitigation Area, including fencing, ungulate removal, and outplanting; radio-telemetry research project.
Hawaiian Goose Take	5 adults	Funding to conduct predator control or support egg and gosling rescue at Haleakala National Park.
Blackburn's Sphinx Moth Take	Capture for translocation; mortality not anticipated; loss of 0.3 acres of native habitat and 27.7 acres of degraded habitat.	Restoration of 6 acres of dryland forest in the Auwahi Forest Restoration Project; outplantings of larval and adult host plants.